Science AMA Series: I'm Matt O'Dowd, writer & host of PBS Space time and astrophysics professor at City University of New York where I research black holes, quasars, gravitational lensing, and galaxies. AMA!

$Matt_O Dowd^1 and r/ScienceAMAs^1$

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Abstract

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the WINNOWER

REDDIT

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MATT_ODOWD R/SCIENCE

Hey Reddit,
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In a recent Physics class we were talking about the energy of a photon with the formula:

Ef = hf

My question is: how is it that a photon can be red shifted by the expansion of space and not defy the laws of conservation of energy?

I've tried to google the issue but most answers say that you have to look at it from an initial frame that is not moving and you will not see the change. So if I would have an hypothetical way to look at a photon that has traveled a long way from me I would still observe the photon with the same frequency. But I don't really get how this works.

legidstyle

The answer seems to be that energy as defined by Newtonian mechanics is NOT conserved in an expanding universe. Physics Girl on YouTube has a great discussion: https://www.youtube.com/watch?v=GHCc9b2phn0

The reason for this is that energy conservation depends on the time symmetry of the universe, as Noether's theorem tells us. But an expanding universe is not time-symmetric. So the energy of cosmically-redshifted photons is lost to nowhere, and the energy in new dark energy comes from nowhere. But energy isn't really a "thing", it's just a mathematical bookkeeping device.

Now there are energy analogs or, if you prefer, generalizations of the concept of energy that ARE conserved in general relativity and in an expanding universe. Even these are still bookkeeping devices, albeit useful ones that may tell us real, physical things about the universe, just like the Newtonian concept of energy does.

(If I understood this properly..)

If Gravitons do exist, as force-carrier particles (which IIRC is affected by curvature in spacetime and travel at the speed of light), how do they escape the event horizon of a black hole to tell us about gravitational force produced by the mass of the singularity at the center?

Draco25240

Ooh, good question. From a purely general relativistic perspective, a black hole IS its spacetime curvature, and it's not necessarily meaningful to talk about a point mass at the center "producing" that gravity. It's possible to write down a solution to the Einstein equations describing an "eternal black hole" in a universe with no actual mass, in which you have an event horizon that persists but nothing to have caused it. That's a complicated way of saying that once you have an event horizon, that spacetime curvature persists independently of anything inside the horizon. So, how does this relate to gravitons? Well if they exist these would be quanta of the gravitational field, and that gravitational field exists external to the event horizon. The gravitons don't need to emerge from below the event horizon; they would BE the gravitational field above it. Not that they necessarily exist anyway. I'm an old-school Einsteinian curvature guy.

Hi ! I'm finishing a PhD in astrophysics, I love science and I'm convinced it has a beneficial effect on mankind. However, I'm often struggling with the "Why should we spend public money to study abstract concepts or extremely far away objects ? Isn't there anything better we could do with the money ?" I use the regular answers: research pays off greatly, hidden applications, sense of wonder, etc. However I'm often left with a strange feeling when my colleagues are battling budget cuts while primary schools, social services, hospitals get their funds slashed as well. Here is my question: at which point do you think the science budget *should* be cut ? What has priority over pure science ?

Timsalan

Hey, congrats on approaching the end of the PhD! Feels good, doesn't it?

Seems like there's a huge gap between current funding levels for fundamental research and "too much", especially given what a lot of our tax dollars are spent on. But how much is too much? I'm probably biased, but I guess it's when all of the talented scientists are already making their incredible contributions to the future of humanity, or deepening our understanding of this amazing universe. I don't think it makes sense to imagine that every dollar that goes into fundamental research is a dollar taken out of building primary schools. How we channel our resources and efforts as a society is always going to be a balancing act. The balance is currently way off, and it's not on the side of research funding OR primary schools and social security.

How does an astrophysics professor end up with their own YouTube PBS show? Did they reach out to you, or did you reach out to them? Do you have connections within PBS? I'm just curious how you ended up being able to do something as cool as this :)

Also, what is your favorite type of AGN?

Cletus_awreetus

The main factor was luck. The astrophysics community in New York is pretty tight, and so I know Gabe (the previous host) from hanging out at the Astrophysics Department of the American Museum of Natural History. When he decided to take a job with the NSF in DC word spread around the community of an empty green screen needing a new astrophysicist.

Favourite AGN? Wow, that's like choosing a fav child. But I can totally do it. Blazars are clearly the most awesome of all AGN. My PhD work was on BL Lacertae objects, but any blazar is cool in my books.

What do you think is the most realistic method of making interstellar travelling a reality and how far are we currently from achieving it?

Actuaely

I think the Breakthrough Starshot program seems pretty plausible, and that could get our probes to Alpha-Cen in 40-50 years. I talk about that a bit here: http://bit.ly/1UvJWPG

Of course the "breakthrough" in Breakthrough Starshot is the use of a "nanocraft", so, super lightweight everything. To get people to another star system we'd need a bigger boat. It's hard to say which engine type will achieve the necessary giant breakthroughs first. If we can learn to MASSIVELY improve the efficiency of harvesting antimatter, then matter-antimatter annihilation is about as efficient a mass-to-energy output that you can achieve. That's probably a way off. If we had to get people to another star system urgently then it's plausible that various types fusion engine could do it and be ready much more quickly. Check out the vid we made on the options here: http://bit.ly/1UZRG1F

Hello Matt. Can you please share your thoughts on Stephen Hawking's new theory about how it is possible that not all information which enters a black hole is lost forever.

leforian

I haven't read the paper, so can't comment in detail. However I was getting worried about all of that information. I'll sleep better knowing it's safe and sound and still in our universe.

But seriously, our understanding of black holes is pretty limited due to the absence of a theory of quantum gravity that can describe the interiors of black holes, and what happens to the interior as the black hole evaporates. I'll hold off on worrying too much until we get a bit closer to understanding this.

How necessary is it nowadays to get a PhD in physics (or some aspect of that field) rather than just an undergrad degree? My friend, a physics major, was discussing with me his plans for the next few years, and he said that he needs to get a PhD in order to be successful at all. He also spoke to me about the "publish or perish" mentality. How do you feel the idea of publish or perish affects young physicists in the making? Also, thanks for those amazing weekly videos, every Wednesday I look forward to checking my subscriptions for the next video!

WinkyBumPooTitty

If you want to do science research then a PhD is pretty essential. I know of a couple of exceptions, but the PhD is the surer route. However I wouldn't recommend doing one unless you know you need it for your career goals. The $$ you'll earn after typically aren't commensurate with the amount of time you spend in school. Unless you get a YouTube show - then you make the big bucks. Hahaha :'(

Do you think we will have direct evidence of dark matter through experimentation in the next few years and if so how will this impact your research?

Powermonger_

This evidence could come at any time. In the next few years? Yes, if certain models of it are correct. There are several experiments that are currently online and looking hints of dark matter particle. The LHC is one of them, but there are also efforts to spot the interaction of a dark matter particle with an atomic nucleus (e.g. in a giant take of liquid xenon), or to see the gamma rays produced as dark matter particles (hypothetically) annihilate each other in space.

How will its identification affect my research? Well, modeling gravitational lenses requires modeling a dark matter distribution in the lensing galaxies. So a better understanding the the behavior of dark matter could constrain the ways dark matter can be distributed in these galaxies. It'd make modeling easier!

When the gravitational waves announcement was made there was a lot of hype about how we've found a new way to 'see' the universe. This sounds cool in theory, but given that LIGO is an enormous, multi-kilometer structure, how realistic is this in practice? Will gravitational wave detectors eventually get smaller/more sensitive until the point where almost anyone can own one, that is capable of detecting GWs from much less 'visible' sources than a black hole merger?

GeniDoi

The size of LIGO isn't the impediment. Future detectors will be larger (and in SPACE!) It's true that you could improve the sensitivity of the system and so reduce its size, but instead we'll both improve sensitive and increase size! The sensitivities we'll attain will certainly turn gravitational wave detection into true gravitational wave astronomy. Even now, the one (published) detection by LIGO has told us stuff that we never knew. In particular, that black holes that big are probably a lot more common that we thought.

In a quantum metastability event, would our universe just pop out of existence all at once? Or would the collapse radiate out from a source at the speed of light?

Also, what did you think about Interstellar?

Codaflow

It would be like a speed of light Nothing from the Neverending Story. It would actually take a while to destroy the universe, and, in fact, if it happened beyond our cosmic event horizon we'd never even know.

Interstellar was OK. I was hoping for something more hard sci-fi, with genuinely interesting speculative ideas about the future. Instead we found out that black holes are magic (however accurately they're visualized).

Hey man, love your work.

Watching some of your vids hurts my brain, even though it is in a good way. What hurts yours? What do you still struggle to comprehend? Do you ever suffer existential crises?

Methuen

Oh, hell yeah. Most of the Space Time episodes hurt my brain as I'm researching and writing them. The current stuff on quantum physics is likely to break my brain entirely. And existential crises? Sure, that's part of the fun. As long as there's a green screen and a camera in the madhouse I'll be happy.

Hi Matt, thanks for stopping by! My question is what specifically astronomers are going to be looking for when the James Webb Space Telescope finally does launch (hopefully in 2018). What insights if any could the telescope give us about black holes that would be more significant than what the Hubble could accomplish?

twominitsturkish

JWST will see so much! It's hard to even start to make a list. In terms of black holes, it'll make a couple of huge advances:

It's ability to see deep into the infrared universe will allow us to observe the very first stars, galaxies, and quasars that formed. The latter will teach us how the first black holes in the universe started to grow. We already know that the brightest quasars in the first ~billion years since the big bang had black holes that are way larger than we would have expected, given the short time they had to grow. JWST will see fainter quasars from the same epoch and allow us to map that growth.

Infrared light also holds secrets to black holes in the more nearby universe because active black holes tend to be surrounded by giant donuts of infrared-glowing dust. Mapping that stuff with unprecedented resolution can also tell us about black hole feeding.

Hi Matt. Love your videos, you do a great job at explaining complex phenomena simply. Another shoutout to your video team.

What's the deepest v neck you own? Have you ever considered wearing a turtleneck to mix it up a bit?

Fleurr

Hey Fleurr, thanks for the compliment. I'll pass it on to the team. My deepest v-neck is really just t-shirt sleeves and nothing else. Super comfortable!

Hi Matt!

According to what I understand via Lawrence Krauss' Universe from Nothing, there is an omnipresent quantum foam that is full of virtual particles constantly appearing and annihilating. I had a couple questions about this:

Does the unending creation/annihilation of virtual particles provide the energy that creates **Time**, nudging quantum particles around to create atomic-scale time?

Are these reactions creating *new particles* (is the universe still banging)?

Do they have anything to do with Dark Energy, could they be creating small amounts of energy?

EvilVegan

Hmmm. I've never heard of an interpretation of quantum foam particles creating time. These little guys are vibrations in the fundamental fields, just like regular particles. Their relationship with time will be

the same, except that virtual particles only exist for tiny time intervals allowed by their energy and the Heisenberg Uncertainty Principle.

However, in general the notion of time is different for the fundamental particles compared to macroscopic objects. I talk about it a lot in this playlist: http://bit.ly/1nn77TF

And yeah, the quantum vacuum energy that gives rise to these virtual particles COULD be the source of dark energy, but there are some big problems with this idea.

I love PBS Space Time! What was it like taking over the show for the first time? Are you surprised at how many people watch the videos and put an honest effort into understanding topics that may be a little over their heads?

Ice_tits

We were all surprised. We wanted to do a show that didn't pull punches, didn't condescend to our audience, and didn't spin misleading nonsense. We thought there would be a niche for that content, but had no idea how much of a hunger there was for that type of rigour. This was becoming clear when Gabe was still host, and he's largely to thank for defining this direction for Space Time. I was lucky to take over knowing I could go pretty hard with the tough science. Even then, we were surprised at the continued growth.

Hi Matt, u are awsome! :)

I just have one question. Could you eleborate how string theorists explain singularity in the center of the black hole since they say that the smallest pieces of matter are made from vibrating strings of energy?

Thanks for answer, hope that PBS Space Time will last for a long time :)

smtdota

Hey, thanks smtoda, so are you! One of the fun things about string theory is that it allows you to avoid the singularity at the heart of the black hole. Uh, that's about all I know. String theory is hard.

Hi Matt! As you know, there are a bunch of different interpretations for quantum mechanical phenomena. What's your favorite, and why? Thanks.

LemonLimeBalloon

Both the Copenhagen and the many-worlds just rub me the wrong way for some reason. They feel like dead ends. I'm more comfortable with ideas stemming from quantum field theory, in which the wavefunction is made of more tangible stuff. Stuff that can be investigated further!

I have a few questions, if you dont mind. You don't have to answer them all, of course.

What got you interested in space, and science in general? And/Or when did you know that you wanted to be a scientist?

Which 'theory of everything' do you support, if any? Any particular reason why?

And finally, on a less scientific note. A friend is visiting New York for the first time, and they've asked

you to show them around. Where do you take them?

Thanks for your time! Love the youtube content, keep it up. And best of luck with your research :)

Pyrobob4

I'll answer 1. and 3., because I don't have a preferred Theory of Everything, except that I'm the into gravity as a particle (for no good reason).

1. Not sure there was a single event. My parents worked like crazy to send us to decent schools, and access to a decent education was pretty huge. After that, I'd say the incredible mysteries of the universe were more than enough to pull me in :)
2. AMNH, of course (after hours, of course!), my favourite bars in the East Village, and a Brooklyn Bridge-Dumbo-Manhattan Bridge bike tour, timed to get sunset on the way back into the city.

Please confirm or deny that this Is you in the background at the ORBCOMM-2 launch.

champ2153

Either denied, or I quantum tunneled to Cape Canaveral. That gentleman does have a very handsome beard though, don't you think?

What advice would you give a student who, on one hand, is determined to become an astrophysicist and make valuable, long-lasting contributions to this field (and by extension, to humanity), but on the other hand, is constantly discouraged by professors/mentors/others who say that the prospects for a career in astronomy are not so good?

madame_scientist2020

Wow, this is really tough. The prospects are not optimal, it's true. There are way more PhD graduates than there are long-term research positions. That said, if astrophysics is really your driving passion and you actually like the idea of spending ~5+ years learning how to do cutting edge research (and don't mind being poor for that long), then go ahead and apply to grad school. Even if you don't end up in academia, PhD astrophysicists are HIGHLY employable in other fields. Also, mad bragging rights.

Matt, I'm a huge fan of what you've been doing with Space Time. What I'd really like to know is, How can I meet you? Do you have any plans for meet-and-greet type events in the future, or giving talks at universities, or something like that?

Gythan

I recently gave a talk on gravitational waves at my home institution, Lehman College, and a few awesome Space Timers came along. I'm about to head to the Netherlands for a conference, but my 15 minute talk will be pretty obscure. Later in the summer I'll do some smaller events in New York City and will definitely let people know.

Hi Matt, I love how enthusiastic you are on PBS Space Time, when was the time when you were the most excited about a new discovery in science.

314GeorgeBoy

Gravitational waves! This is the most important discovery that happened during the science-obsessed part of my life (most of it). It changes everything.

Hi Matt. As a physicist, when you were in school, were you always good at math or would/did you consider yourself a great math student?

randombiketrips

Decent at math(s), but by no means a mathematical genius. For example I could never have been a pure mathematician. Not just lack of ability; I really need to see the correspondence of math to the physical world for it to even stay in my head. This is also why I'm not a string theorist ;-)

Hey Matt, what's your personal opinion on the new particle discovery you discussed in the recent PBS Space Time episode, and what do you think is the most probable explanation?

Leesin2me

You mean this one? http://bit.ly/1U3Re2X

A lesser known extension to Occam's Razor is that the most boring explanation is usually the correct one. The least "physics-breaking" explanation is that it's a composite of other particles, and in particular a composite of quarks and anti-quarks, like a gigantic proton or even-more-gigantic pentaquark.

I question I always had is how warped space time caused movement (gravity). Especially if the object had no motion in space, how can warped space time cause the object to "fall"? Thank you,

SirYarwood

Warped spacetime (actually just the warped time part) results in inertial frames moving "down". This video has a great graphical depiction of this: https://www.youtube.com/watch?v=DdC0QN6f3G4

LIGO detected the merger of two black holes - one 36 solar mass, and the other 29 solar mass. According to LIGO, "the coalescence converted about three times the mass of the Sun (or nearly six million trillion trillion kilograms) into gravitational-wave energy", and the resultant black hole is 62 solar masses. Does that 3 solar mass of wave energy represent significant information loss from the black hole(s)?

eChaos

Not my area of speciality, but I don't think this is the case. Any information carried by those black holes would be at the event horizon, and the gravitational waves could in principle carry that information away with them.

What are your thoughts about the "impossible" EM drive? Would you consider doing an episode about it?

soverign5

Not until there's much more solid evidence. From my reading, not nearly enough of the confounding factors have been accounted for. Extraordinary claims require extraordinary evidence.

Hello Matt! What do you do in your spare time besides physics? (Sports? Hobby?)

Cetex

Doing Space Time and simultaneously being a full-time professor doesn't leave a lot of spare time. When it comes I keep it simple at the moment - I hit the gym, see friends, binge whatever Netflix series (Parks & Recreation right now), play the odd game of D&D, get out of town for some nature/beach/crazy festival time.

Hi Matt! Any relation to Chris O'Dowd? https://en.wikipedia.org/wiki/Chris_O%27Dowd

616C6578

Well, very distantly I suppose. We're both "decended from Fiachra, brother of Niall of the Nine Hostages, through Daithi, the last pagan King of Ireland who, legend has it, was killed by a bolt of lightning as he led an army to the foot of the Alps in 455 AD".

For what it's worth, so is Boy George.

Thank you so much for producing an incredibly pedagogic and entertaining program. I am a big fan. Are you personally a fan of any other web based shows concerning astrophysics, cosmology or perhaps something on a totally different note?

3rdWonder

My favourite science shows would be MinutePhysics, Veritasium, Physics Girl, It's OK To Be Smart, and Braincraft. I'll click on any notification of a new vid from these within about 3 seconds.

What, if anything, do you have to report that's exciting and interesting but not yet really known about in the non-scientific community? Alternatively, is there anything you'd like to be asked about?

SavannahWinslow

You'll soon hear more from LIGO...

How long is the wait time to get a project using the hubble to make it through the queue. Is it an "importance for science" type of list or "important for donor funds" type of list?

Frootofthewomb

NASA issues a call for proposals every year, and if you're successful your observations will be taken some time in the following year. So from submission of the proposal to getting the data is 6 to 18 months. Assuming you're one of the ~10-15% to have a proposal accepted.

There is no donor list. It's all done on a competitive basis, with your proposal reviewed by a panel of peers.

Based on the challenges in SpaceTime I assume that you r/theydidthemath things in your spare time. What is your most bizarre/interesting/unnecessary r/theydidthemath moment?

PancakeLegend

Thanks. You just killed a week of my time. I'd never see it until now.

What is a common "pop-sci" explanation that *particularly* bothers you? How do *you* explain that phenomenon to non-physicists, and why is your explanation better?

EuphonicSounds

Any hokey pseudo-spiritual misuse of ideas in quantum mechanics really bugs me. "What the Bleep" is the worst film ever made.

Hi Matt, In the influence of matter falling into a blackhole, I've heard that the matter sees time as the same and just falls through the event horizon, but to the outside observer, this action takes an infinite length of time. If this is the case, what radiation of energy do we see and how far from the event horizon is this energy released?

rrodberg

The math says that we should see an object fall towards the event horizon and witness it's flow of time slow down as it approaches. Very near the event horizon, the flow of time affecting the falling object should appear to approach zero for a distant observer; we see it's clock almost stop. However the light we receive from that falling object gets also redshifted as it approaches the event horizon. That means that the object will vanish to our sight - not because it crosses the horizon, but because the light it emits is redshifted to such long, low energy wavelengths that we couldn't detect it.

Would you rather fight a black-hole sized quasar, or one-hundred quasar-sized black holes?

LifeWin

This question doesn't make sense. All quasars are powered by black holes! But the first one. A quasar the size of a black hole is a pretty small quasar (even if it's a supermassive black hole sized quasar). A black hole the size of a quasar (~1 light day or so) is terrifyingly gigantic. And 100 of them? Nope.

Hi! What are your ideas about dark matter and dark energy, if any?

What is you absolute favorite celestial body?

What is the most mind blowing thing you've come across

What is your favorite space fact?

What got you into the field?

Have you ever met Dr. Tyson? What's he like?

If you could go back in time to meet a scientist who would it be?

Saturn and Jupiter were once closer than they are now to the sun. What happened?

There's a theory that there once was a planet between Mars and Jupiter. What are your thoughts on that?

Why are some stars very large, but not supermassive?

Who is your all time favorite scientist?

Do you have a favorite planet?

What advice do you have for someone beginning their journey to a degree is astrophysics?

I apologize for so many questions. This is exciting stuff to me. Thanks for holding the AMA!

Starstuff8

I'll answer one of these: I'd travel back to meet Einstein. No contest. What a beautiful mind.

Hi Matt!

What resources would you recommend to a math and science savvy person who wants to learn more about advanced cosmology (other than Space Time)?

Love the show. Hope it sticks around for a long time!

hanzyfranzy

I really like Leonard Susskind's Stanford lecture series. I recommend the cosmology series, starting here

Hi Matt! I absolutely love your videos and I've learned so much more than I thought ever possible about space and physics. At times it's very difficult to understand due to the nature of the subject matter. I am a little educated on quantum physics but by no means an expert.

Do you think any of the material of your videos should be taught in school before college? Do you think kids should be taught about quarks and dark matter as we are taught about protons and gravity?

Thanks!

santasmic

I WISH I'd been taught about quarks and dark matter in high school. But should everyone be? Probably not. I'm a fanatical believer in giving very high schooler a strong basic foundation in science and math. Give them that and you'll prevent this science-phobia that is so, so common in people whose schools failed them in this respect. Give kids the right mental tools by teaching the foundations of scientific thinking, and their curiosity will lead them to the cooler details.

Had a thought yesterday. Replace the moon with a black hole of equal mass. Wouldn't a solar ellipse be a mega-disaster due to lensing?

dementiapatient567

A black hole with the mass of the moon would have a Schwarzschild radius of about a tenth of a

millimeter. The region around it exhibiting strong lensing would be so small as to be undetectable. Shame. A black hole space death lens is a cool story idea.

Would you choose to visit Mars if given the opportunity?

MusicMan5000

Definitely! I demand at least a 50% chance of survival and a two-way transport, but otherwise I wouldn't miss it. You?

Will you ever fix the Earth's rotation in your intro?

ImpartialDerivatives

The rotational direction is correct from a tachyonic perspective. We totally intended that.

I LOVE PBS SPACE TIME. Thanks for making such an awesome show. I'd like to know, if you could have one universal/existential question answered, what would it be?

bensona42

What is the nature of the most fundamental component of reality? When we've dug as far as we can, what will we find at the bottom?

What happens if a black hole "eats" a smaller black hole?

riotinmyhead

Nom. Bigger black hole. This happens all the time. It's exactly what LIGO saw last year.

Hi Matt, love the show. What are your thoughts on ER=EPR and are you planning on doing anything in the show to do with the interior of black holes?

ReaperUnreal

ER=EPR is a tempting idea, although it's a bit contrived because a wormhole bridge should, in the simplest interpretation, allow FTL transfer of information. Quantum entanglement doesn't seem to allow this.

Hey Matt,

I am currently studying to get my B.S. in Physics. My end goal is to get a PhD in Astrophysics. For a career after college I really want to work in science communication. I don't know if that means doing a YouTube show or something else. What I do know is that I want to educate the masses on the wonders of our Universe, why it's important to study it, and keep kids interested in science.

Do you have any recommendations that might help me achieve this goal?

Big fan. Thanks for all the free content.

Invictus

My main piece of advice would be that you start early with the science communicating! I wouldn't necessarily try to push highly public formats. Focus more on your skills as an educator. Tutor, write, give talks at schools, and if you have a chance to do undergraduate research then jump on that and take opportunities to present your results. In grad school you'll have the opportunity to teach classes. Definitely do that. But if you're inspired to do a blog, podcast, or some YouTube videos then by all means. Don't wait for someone to offer you a show!

Hello Matt, In experimental astrophysics are the majority of theories incapable of beinging tested due to technological challenges, or are their some that could be tested today but simply lack funding and resources, if so which ones would you like see tested?.

Thank you for the AMA!

LoL_Honeydew

There's so much we could test today using existing or very near-term tech. 30 meter class telescopes with state-of-art adaptive optics are set to revolutionize the field, but getting them built and online is slow for various reasons, but more money could solve a lot. One really big disappointment was the exit of USA from the LISA (Laser Interferometer Space Antenna) program. It's still happening, driven entirely by ESO now, but the withdrawal of US money meant significant downgrades to the plan.

Professor Dowd, thanks for stopping by. Black Holes are seriously the most interesting topic to me.

Do you do any talks/forums/presentations that the public can attend in NYC? I'vat attended a few talks by Caleb Sharf through New York Academy of Sciences and the Secret Science Club but haven't seen many other events. Thanks and totally excited for your new show!

johnny5ive

I plan to do a few things over the next several months, although dates aren't firm yet. I'll definitely be letting people know, both via the show and on Twitter.

Hi Matt,

Can you give a confused 27 year old some advice. I'm trying to get into a field with NASA but have no idea what to major in. Everything seems so interesting and I'd love to learn all of it but it's really overwhelming which one to choose to go into and fully commit to. Is there any advice you could give me?

gt35r

If you're good at math and physics I'd go with an undergraduate degree there. Physics major is a decent choice, and is highly sellable if you change your mind. If you're more hands on, aerospace engineering might be the way to go. Computers your thing? NASA needs computer engineers too. Engineering in general will earn you the best $ even if you don't stick with the NASA dream.

What kind of data do you have to work and research on?

Is it purely mathematics, or do you deal with the limited information we can gather from the energy of

such objects that we can detect? How fast is the progress to get new data through new ways to detect energies or new stellar objects that are found?

LuckyNobody

I work with data from a variety of telescopes. Right now I'm using a lot of Hubble and Gemini data. The actual research I do involved building simulations and running calculations that try to make sense of the data. I talk about one of my current projects here: http://www.amnh.org/explore/science-bulletins

Hi Matt, love the show.

I'm currently finishing my Ph.D, and I've been involved with science communication on my campus and in the general community for a number of years through volunteer organizations and events, teaching labs and courses on campus, and giving presentations on my research and about being a graduate student in general. I really do enjoy general science communication and teaching, and I would definitely consider a career with science communication if it was possible.

As someone quite involved with science communication, my question to you is do you have any good suggestions as to what sorts of other activities I should be involving myself with in order to further a career in scientific knowledge translation/communication? Should be I pursuing writing general articles for websites? A scientific blog? A YouTube channel? The whole market of "science communication" seems so saturated with podcasts, videos, etc. that I feel that making a splash in the area would be extremely difficult, and that perhaps you might have some insight as to what avenue I could pursue if I wanted to continue down that path.

Cheers

DocteurTaco

Hey, congrats approaching the end of the PhD. All the best with the last leg. All of those ideas you came up with are good, so you should do what inspires you - write if you love writing, film some episodes if you're into that medium and have cool new ideas. The main thing is to work on your sci-comm chops. Communicating complex concepts to a lay audience is a tricky skill. Get good at it and you'll find your audience.

Hi, love the show. What is your opinion on the current state of space exploration? And if you had the chance to go to space, would you?

KSPReptile

I'm biased, but I think a ton more money should go in what is clearly the most excellent of all pursuits. And yeah, I'd go in an instant. I mean, given at least an even chance of survival.