

Episode -3½: **Hunting Dark Matter Clouds**

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Written by: *Pamela Gay with Aaron Price*
Disembodied Voices: *Travis Searle & Pamela Gay*
Engineering & Production: *Travis Searle*

Travis: Welcome to the February 16, 2005 edition of Slacker Astronomy, a podcast about astronomy and just about anything else that floats over our heads. Every week or so we will bring you a summary of a recent news event from the world of astronomy. And during slow news weeks, we'll make stuff up. If it's good enough for CBS then it's good enough for us. Unfortunately for "On the Media," today's podcast is true, and it's about the most dark and mysterious stuff in our Universe: Dark Matter.

Pamela: The phrase "What you see is what you get," is often applied to graphics, discounted dishwashers, and factory seconds in the outlet malls. "What you see is what you get" is not a phrase that can be applied to our universe. In fact, what you see is only about 2 percent of the Universe's total mass. The rest of our cosmos is made up of mysterious dark matter and dark energy. Both these dark substances are detected through the tugs and pulls of their gravity on the visible parts of our cosmos. Looking through space, we can watch dark energy push our universe apart, while dark matter speeds up of gas clouds orbiting on the edges of galaxies and accelerates galaxies on the edges of galaxy clusters.

Travis: The search for dark matter is one of the longest running games of hide-and-seek in modern astronomy. When astronomers first saw the deformed orbit of Uranus they went searching for an additional outer planet, a dark mass in the outer solar system, that was pulling Uranus's orbit out of the round. This was one of the first dark matter searches.

Pamela: In 1846, careful calculations by both John Couch Adams and Urbain Le Verrier allowed Johann Galle at the Berlin Observatory to discover Neptune on his very first night of searching. This is something like finding the only a needle in a haystack in the first handful of hay you look in. Where once Neptune was nothing more than unidentified dark matter, careful observations allowed this one bit of dark mass to be made visible.

Travis: Modern astronomy continues to find new ways to poke and prod at the dark matter that makes up 27 percent of the universe. With the invention of radio telescopes, never before seen cold gas clouds were discovered orbiting in our outer galaxy. With the launch of X-ray telescopes, hot gas in galaxy clusters was made visible. With every new instrument, we increase our inventory of matter, slowly moving things out of the dark matter column in our cosmic inventory and placing them on the list of known objects.

Pamela: The newest cosmic inventory update was turned in by the Chandra X-ray Observatory and a team of astronomers lead by Fabrizio Nicastro of the Harvard-Smithsonian Center for Astrophysics. Like Johanne Galle before, Nicastro's team based their search on calculations. Computer simulations of the formation of galaxies and galaxy clusters show that some dark matter may take the form of extremely diffuse webs of gas clouds. These clouds are too diffuse to easily see from Earth. If you imagine trying see a cloud of lightening bugs over a Pennsylvania field while standing on the moon, you can start to understand just how hard it is to see these clouds. Rather than looking directly for these clouds, Nicastro and his team looked for them in the light of a distant quasar.

Travis: Our Pennsylvania lighting bugs become annoyingly visible as moving shadows if they swarm in front of a drive-in movie projector. Similarly, our cosmic clouds are most easily seen when they swarm in front quasars. Two Chandra observations, in October 2002 and July 2003, of the quasar Markarian 421 showed two separate clouds of gas located 150 million and 370 million light years away. The clouds were detected as dark lines in the quasar's spectra where each cloud absorbed a small part of the quasar's light.

Pamela: These clouds, and clouds like them scattered throughout the universe, may make up as much as 2% of the universe's total mass. Nicastro and his team, in one set of well-planned observations, doubled the amount of inventoried mass in the universe. With 4% of the universe inventoried, we only have another 96% to try and understand.

Travis: Nicastro and his team's results can be found in the Feb 3rd issue of the journal Nature. Links to the Chandra press release and artists images of these dark matter clouds are available in our show notes on our web site. Stop by to subscribe to our podcasts, download past shows or to just spam our discussion boards with conspiracy theories. Just make them humorous at least. I'm Travis Searle and on behalf of Pamela and Aaron thanks for listening and no, you don't get your 4 minutes back.

Pamela: Clear Skies and Clear Bandwidth. This has been Slacker Astronomy, a volunteer collaboration for you, for fun, for the voices in our heads.