Astronomy

Dusting the galaxy

Cosmic dust is one of the two major inhabitants of interstellar space in our and other galaxies (gas clouds are the other). In visible light the dust manifests its presence in a negative, subtractional way by absorbing light and so dimming and reddening the appearance of stars. However, the dust scatters X-rays and so provides halos for the images of point X-ray sources belonging to our galaxy. By studying those halos, Christopher W. Mauche and Paul Gorenstein of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., have deduced something about the size of the dust grains and their density and composition.

Using observations of the Imaging Proportional Counter on the Einstein Observatory satellite, they found first that the intensity of X-ray halos represents an amount of dust consistent with what astrophysicists had calculated from the observed absorption of visible light. In a paper submitted to the ASTROPHYSICAL JOURNAL, they report that the halos cannot be caused by dust grains of a uniform size; there must be a certain distribution of sizes. Theorists have proposed two mathematical schemes for such a distribution, the Mathis-Rumpl-Nordsieck (MRN) formula and the Oort-van de Hulst formula. Although both formulas could account for the halos, the totality of evidence makes Mauche and Gorenstein favor the MRN, which is basically a power law distribution, that is, the number of grains of a given size is proportional to some power of that size. The average size of the grains is about 0.1 micrometer (1/10,000 of a millimeter) and their density about 1 grain per hundred cubic kilometers (10^{-12} per cubic centimeter).

Chemically there are two components: graphite grains ranging from 0.005 to 1 micrometer and "silicate" (which could be enstatite, olivine, silicon carbide, iron or magnetite) grains ranging from 0.025 to 0.25 micrometer. From all this Mauche and Gorenstein could calculate that approximately all of the silicon, magnesium and iron and 60 percent of the carbon in the interstellar medium is locked up in dust grains. These figures correspond, they say, to what astrophysicists can calculate independently from the observed composition of the interstellar gas.

The longest cosmic filament

Evidence is growing that the matter in the universe is not evenly distributed on the large scale, as astronomers have generally assumed, but instead is gathered in long filaments. The filaments are made of galaxies and clusters of galaxies strung like beads on a chain, with largely empty spaces between the filaments. This gives the universe an appearance like Swiss cheese.

Two astronomers from the University of New Mexico in Albuquerque, Jack O. Burns and David J. Batuski, report the finding of a filament more than a billion light-years long. This is the longest yet known, surpassing the previous record holder (found by the same two astronomers in 1982) by more than 300 million light-years. The newfound filament is in the direction of the constellations Perseus and Pegasus and runs between 200 million and 1 billion light-years from earth.

The data that led to the discovery were recorded by the Intensified Image Dissector Scanner on the National Optical Astronomy Observatories' 84-inch telescope on Kitt Peak in Arizona. This instrument recorded the redshifts of the various components of the filament, permitting the astronomers to calculate their relative positions in the third dimension. Collating this information with two-dimensional images led to the deduction of the connected structure of the filament.

One of cosmology's chicken-and-egg questions is whether galaxies or clusters came first. Burns and Batuski say their data indicate that superclusters formed first and then fragmented into galaxies rather than galaxies forming first and then associating into clusters.

Behavior

Busting the bulimia 'epidemic'

A number of recent media and medical reports suggest that bulimia — an eating disorder that involves bingeing and purging — is reaching epidemic proportions among young women, particularly those attending college.

These accounts, however, vastly overestimate the problem, according to Kathleen J. Hart and Thomas H. Ollendick of Virginia Polytechnic Institute and State University (VPI) in Blacksburg. A large number of women report going on an eating binge at least once, but less than 5 percent have other symptoms that characterize bulimia, say the researchers in the July AMERICAN JOURNAL OF PSYCHIATRY.

Two samples of women were given questionnaires on their eating behavior. The first group of 139 subjects was obtained from a total of 300 women, ages 18 to 30, employed in a large banking institution and contacted through interoffice mail. Another 234 women were recruited for the study at VPI and were, on average, several years younger than the working women.

At least one episode of binge eating was reported by 41 percent of the working women and 69 percent of the university women. Yet only 1 percent of the working women and 5 percent of the university women had three other markers of bulimia: depressed and self-deprecating thoughts following bingeing, fears of not being able to stop eating voluntarily and self-induced vomiting on a weekly basis.

"Although binge eating is not uncommon among women between 18 and 30 years of age, the prevalence of the syndrome of bulimia is significantly less common," conclude the investigators.

Behaviors associated with bulimia occur more frequently among university women when compared with working women, they note. The reasons for the difference are unclear, say the researchers, and any speculations are limited by the fact that 54 percent of the working women contacted for the study did not complete the questionnaires.

Alone with your fears

Severe anxiety disorders such as panic disorder and agoraphobia have been the objects of a number of recent research projects (SN: 3/30/85, p. 199). But an anxiety disorder with promising research possibilities — social phobia — remains largely unstudied, assert psychiatrist Michael R. Liebowitz and colleagues of Columbia University in New York City.

Social phobics fear scrutiny or evaluation by others, they explain, and feel more comfortable if they can be alone. Fears of eating, drinking, shaking, speaking or vomiting in the presence of others are often part of their phobia. People with panic disorder may have similar fears but also have anxiety reactions in nonsocial situations such as in subways or tunnels; they tend to avoid places where a quick exit is difficult and feel comforted by the presence of familiar people.

There are "major uncertainties," note the researchers in the July ARCHIVES OF GENERAL PSYCHIATRY, concerning the definition, prevalence, causes and treatment of social phobia. In the United States, only behavior therapists have paid much attention to treating the disorder. British researchers have found that alcoholism and depression are commonly associated with social phobia.

While social phobics are often extremely disabled by their fears, preliminary data indicate they may improve with social skills training, relaxation instruction or the use of beta blocker medication, according to the investigators.

Furthermore, they point out, social phobics are an important comparison group for studies of other anxiety patients. Contrasting more than one phobic group with healthy controls may lead to the identification of a "core vulnerability" among anxiety patients, maintain the psychiatrists.