Quasar Dust in the Early Universe

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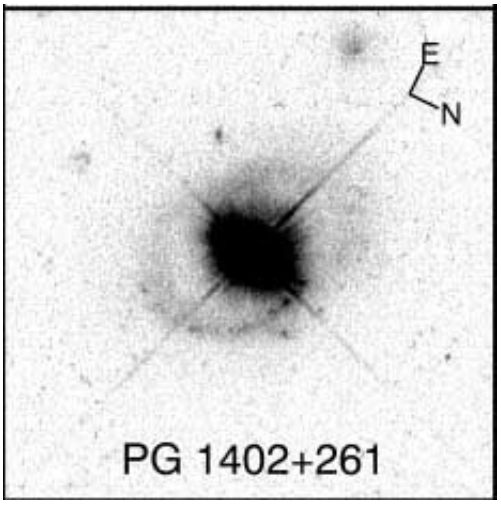

A Hubble image of a nearby quasar. New Spitzer Space Telescope infrared observations of distant quasars, objects whose light traces an early epoch of the universe (about 12 billion years ago), have discovered that some apparently date from a time before dust had been made, or at least before it was readily available. Credit: NASA Hubble Space Telescope

(PhysOrg.com) -- Quasars are galaxies whose very bright cores are thought to contain massive black holes around which disks are actively accreting matter.

The accretion process releases vast amounts of energy, and as a result quasars are among the most powerful energy sources known. No one knows for sure, however, how these objects form, how they develop in time, or how exactly their stupendous energies are produced. Because

they are so bright, quasars can be seen even when they are very far away, and this combination of being both highly energetic and located at cosmological distances makes them appealing to astronomers trying to figure out the nature of galactic center black holes (our own Milky Way has one) and the conditions in the early universe that prompt these monsters to form.

There are about forty quasars known to be so far away that their light has been traveling toward us for over twelve billion years; in other words, their black holes were already glowing brightly when the universe was very young - less than one billion years old. The question is: do they look like nearby quasars, or are they different somehow? CfA astronomer Yue Shen is a member of an international team of twelve astronomers that has concluded that some remote quasars are very different indeed.

Using the Spitzer Space Telescope's sensitive infrared cameras, the scientists observed twenty-one distant quasars to see whether or not they could detect evidence for hot dust; such dust would be expected if there really is a hot accreting disk of material around a black hole. Indeed, hot dust is a characteristic feature of quasars in the local universe.

Remarkably, as the team reports in this week's issue of *Nature*, two of the quasars in their study show no evidence for hot dust. The implication is that these galaxies are so primitive (in cosmic terms) that there has not been time for them to make dust, presumably either because there has not been time to form enough of the required constituent chemical elements, or because there has not been time to assemble them into dust grains. The results suggest that these objects date from an epoch in the universe when dust was first being made. Dust is a key catalyst in turning atomic gas into the molecules that facilitate stellar birth and evolution, and this new result is significant not only for quasar research, but also for helping understand how the first few generation of stars in the universe came to be.

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