Title

Powerful High-Velocity Dispersion Molecular Hydrogen Associated with an Intergalactic Shock Wave in Stephan's Quintet

Authors

PN Appleton
KC Xu
W Reach
MA Dopita
Y Gao
N Lu
CC Popescu
JW Sulentic
RJ Tuffs
Min Yun, *University of Massachusetts - Amherst* Follow

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Abstract

We present the discovery of strong mid-infrared emission lines of molecular hydrogen of apparently high-velocity dispersion (~870 km s^{-1}) originating from a group-wide shock wave in Stephan's Quintet. These *Spitzer Space Telescope* observations reveal emission lines of molecular hydrogen and little else. This is the first time an almost pure H_2 line spectrum has been seen in an extragalactic object. Along with the absence of PAH-dust features and very low excitation ionized gas tracers, the spectra resemble shocked gas seen in Galactic supernova remnants, but on a vast scale. The molecular emission extends over 24 kpc along the X-ray-emitting shock front, but it has 10 times the surface luminosity as the soft X-rays and about one-third the surface luminosity of the IR continuum. We suggest that the powerful H_2 emission is generated by the shock wave caused when a high-velocity intruder galaxy collides with filaments of gas in the galaxy group. Our observations suggest a close connection between galaxy-scale

shock waves and strong broad H_2 emission lines, like those seen in the spectra of ultraluminous infrared galaxies where high-speed collisions between galaxy disks are common.

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