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High Velocity Cloud Complex M: A Supernova Origin Story

Abstract

New research suggests that High Velocity Cloud (HVC) Complex M may be the result of a supernova that blew up about four million years ago. Radio data from the 100-m telescope in Germany and gamma-ray data from the NASA's Imaging Compton Telescope reveal a cavity centered at galactic coordinates $(l, b) \sim (150^\circ, 50^\circ)$ with a radius of about 33° . The hydrogen gas of Complex M may have ridden the supernova blast wave to achieve the observed high velocities. Using the known distance to Complex M, we can bootstrap the distance to the original, explosive source of the cavity, $D = 307$ pc, calculate the radius of the cavity, $R = 166$ pc, and approximate the expansion velocity, 40 km/s, of the cavity. The total energy of the expanding cavity is well within the range of a single supernova. As the blast wave from this supernova propagated outwards, it began to sweep up interstellar gas and carve out the Local Chimney, a low-density extension of the Local Bubble that reaches into the galactic halo. The remaining neutron star would be the smoking gun required to prove the supernova model, but without a bright binary companion, a pulsar signature, or mass transfer, it would be all but invisible to us. Fortunately, the very existence of the cavity as well as the physical parameters resulting from the new distance estimate make this scenario a viable contender for the origin story of Complex M.