SN 1987A: A unique laboratory for shock physics

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Supernova 1987A has given us an unprecedented view of the evolution of the explosion debris and its interaction with circumstellar matter. The outer supernova debris, now expanding with velocities \(\sim 8000\ \text{km/s}\), encountered the relatively dense circumstellar ring formed by presupernova mass loss in the early 1990s. The shock interaction is manifested by UV-optical “hotspots”, an expanding X-ray ring, an expanding ring of knotty non-thermal radio emission, and a ring of thermal IR emission from silicate dust. Recent ultraviolet observations of the emissions from the reverse shock and the ring with the HST/COS reveal new details about the shock interaction. Lyman alpha emission from the reverse shock is much stronger than H alpha and they have different emission morphologies, pointing to different emission mechanisms. The reverse shock was detected for the first time in \(\text{C IV}\ 1550\). The \(\text{N V}\) to \(\text{C IV}\) brightness ratio indicates the N/C abundance ratio in the expanding debris is about 100X solar, about 3X N/C in the inner ring.

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