

ALMA2019: Science Results and Cross-Facility Synergies



Contribution ID: 78

Type: not specified

ALMA observes the aftermath of mergers of non-compact stars

Thursday, 17 October 2019 17:10 (25 minutes)

Invited talk

Abstract:

Red novae, a newly-recognized group of eruptive variable objects, are optical manifestations of merging non-compact stars than may be observed in real time. They represent transients erupting at luminosities intermediate between those of classical novae and supernovae. In red nova eruptions, stellar coalescence produces circumstellar environments very rich in molecular gas and dust. ALMA, NOEMA, and SMA have recently revealed the complexity of the cool remnants of such events, including their spatio-kinematic structure and a rich molecular inventory of peculiar molecular and isotopologic composition. The submillimeter observations have provided, for the first time, the masses dispersed during the merger events and revealed bipolar outflows, which strongly constrains hydrodynamic models of progenitor common-envelope systems and violent stellar mergers. Additionally, detailed studies of chemical composition of red-nova remnants have yielded many surprises and include the detection of complex organic molecules and the first observation in space of a “radioactive molecule”, ^{26}AlF . There are numerous similarities between the merger remnants and some pre-planetary nebulae (PPNe) and it is possible that some objects classified as PPNe are indeed old merger remnants. The superb angular resolution and sensitivity of ALMA has helped to establish red novae as a new type of submillimeter source and allows detailed studies of the structure and the highly unusual chemistry of material in the aftermath of an explosion. Future observations will utilize ALMA to identify new Galactic objects of this type, catching their explosions “in the act” and to search for remnants of overlooked historic red novae.

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Session Classification: Stellar Evolution