Contribution ID: **62** Type: **not specified**

Indication of a Pulsar Wind Nebula in SN 1987A

Tuesday, 31 May 2022 17:45 (15 minutes)

Since the day of its explosion, supernova (SN) 1987A has been closely monitored to study its evolution and to detect its central compact relic. In fact, the formation of a neutron star is strongly supported by the detection of neutrinos from the SN. However, besides the detection in the Atacama Large Millimeter/submillimeter Array (ALMA) data of a feature that is somehow compatible with the emission arising from a proto-pulsar wind nebula (PWN), the only hint for the existence of such elusive compact object is provided by the detection of hard emission in NuSTAR data up to 20 keV. I will discuss on the simultaneous analysis of multi-epoch observations of SN 1987A performed with Chandra, XMM and NuTAR. I will show comparison of the observations with a state-of-the-art 3D magnetohydrodynamic (MHD) simulation of SN 1987A. A heavily absorbed power-law, consistent with the emission from a PWN embedded in the heart of SN 1987A, is needed to properly describe the high-energy part of the observed spectra. The spectral parameters of the best-fit power-law are in agreement with the previous estimate, and exclude diffusive shock acceleration as a possible mechanism responsible for the observed non-thermal emission. The information extracted from our analysis are used to infer the physical characteristics of the pulsar and the broad-band emission of its nebula, in agreement with the ALMA data. Analysis of the synthetic spectra also show that, in the near future, the main contribution to Fe K emission line will originate in the outermost shocked ejecta of SN 1987A..

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Session Classification: Parallel Session: Compact objects, Stars, & Planets