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Investigation of Element Processing in the Crab Nebula TIM SATTERFIELD, GORDON MACALPINE, Trinity University — Heavy elements are manufactured in stars. In particular, exploding stars are very effective at distributing heavy nuclei into the interstellar medium, where they may form into new stars, planets, and life. Young supernova remnants can provide our best means for detailed studies of how elements are processed in stars before, during, and after the explosions. The Crab Nebula, the remnant of a supernova observed from Earth in 1054, is ideal for this type of investigation. We are using a numerical photoionization code to analyze the physical and chemical properties at different locations of the Crab Nebula's gaseous debris field. Results of calculations are compared with optical and infrared spectrum measurements in order to understand chemical abundances and the range of nuclear processing. It is found that some gas has apparently not been processed significantly beyond the CNO-cycle, whereby roughly 90% of the material is helium by mass fraction. In addition, much of the nebula has undergone partial helium-burning, leading to a large increase in the amount of carbon, along with conversion of nitrogen into neon. Furthermore, regions with significantly increased products of oxygen-burning can be effectively modeled; and extremely high apparent concentrations of nickel contain mixtures of elements consistent with the recent suggestion that winds may carry iron-peak nuclei away from the surface of the young neutron star in the Crab Nebula.

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