Abstract Submitted
for the DNP06 Meeting of
The American Physical Society

Nuclear Clusters in Astrophysics ALAN H. WUOSMAA, Western Michigan University — Alpha-cluster nuclei are prototypical mesoscopic systems that play significant roles in the most important nucleo-synthesis reactions forming the elements crucial to life on Earth, ^{12}C and ^{16}O. The production rates of these nuclei depend critically on the stellar environment, as well as detailed nuclear structure properties. The famous "triple-alpha" reaction that produces ^{12}C, for example, proceeds through the well known excited 0_2^+ state in ^{12}C which possesses a well developed alpha-cluster character. In massive stars, the properties of and reactions involving cluster nuclei continue to strongly influence stellar evolution through processes such as ^{12}C+^{12}C fusion. Current modeling of stellar evolution has evolved to a stage where new and better data are required to reduce the uncertainties in these theoretical predictions. I will review some of the important aspects of cluster nuclei in astrophysical environments, and discuss some ongoing experimental efforts to refine our knowledge of the rates of ^{12}C production through the triple-alpha reaction, and ^{16}O production via the ^{12}C$(\alpha,\gamma)^{16}$O reaction. Finally, I will discuss some of the challenges that are faced in understanding burning of heavier cluster nuclei in massive stars. Work supported by the U. S. Department of Energy, Office of Nuclear Physics under contracts DE-FG02-04R41320 and W-31-109-ENG38, and the National Science Foundation grants PHY01-10253 and PHY02-16783.

Alan H. Wuosmaa
Western Michigan University

Date submitted: 12 Jul 2006 Electronic form version 1.4