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*Centimeter and (Sub)millimeter Wavelength Imaging of the Photospheres and Envelopes of AGB Stars (Invited)*

A new generation of vastly more sensitive radio- and submm-wavelength facilities is about to start working: The Expanded Very Large Array (EVLA), e-MERLIN and the Atacama Large Millimeter Array (ALMA). All will allow imaging of the stellar photospheres of nearby AGB stars, their atmospheres and their expanding envelopes on scales of a few to many hundreds of AU. The superb spectroscopic capabilities afforded by the new generation highly advanced correlators will not only allow observations of many tens of km/s wide spectra with adequate (sub-km/s) velocity resolution, but also simultaneous imaging of many molecular species, various isotopologues for each. Imaging of vibrationally excited lines from many species will yield unique chemical information on the hottest gas in and just outside the atmospheres before it depletes into dust grains and partakes in the outflows. ALMA, for which a very large number of different molecules are accessible, will thus allow direct, quantitative studies of nucleosynthesis products and element depletion in the stars' inner and the photochemical processes in their outer envelopes. Highly efficient surveys with the EVLA will lead to the detection of SiO maser emission from thousands of oxygen-rich Mira stars throughout the Milky Way and even the Magellanic Clouds, allowing, e.g., detailed kinematic studies of the Galaxy's bar potential.