

By assuming that energy is supplied predominantly *via* the Reynolds stresses, it is possible to reproduce the observed amplitudes of the newly discovered, stochastically driven modes of ξ Hydrae, a red-giant star of mass $3.3 M_{\odot}$ and luminosity $60 L_{\odot}$. However, there remains a serious problem in predicting amplitudes for hot stars such as Procyon.

William Thorne (IoA, Cambridge) explained that, in modelling the effects of rotation in asteroseismology, we are confronted with two choices. Either we scale with gravity, where $f = \Omega/\sqrt{GM/R^3}$ represents the centrifugal distortion of the background state, or we scale by the pulsational frequency, where $\nu = 2\Omega/\omega$ measures the direct effect of the Coriolis force on the pulsations. The traditional geophysical approximation of neglecting the horizontal component of the rotation vector in the Coriolis force is best suited to low-frequency g -modes. The centrifugal scaling can be used to generalize the approximation by introducing distorted orthogonal co-ordinates along the equipotential surfaces. This perturbative approach makes it possible to cover all values of ν , and to obtain frequencies accurate to fourth order in the rotation rate for the centrifugal scaling. It is also possible to correct for the approximation, so improving the results.

Turning to magnetic fields in sunspots, Steve Houghton (DAMTP, Cambridge) described some localized solutions in magnetoconvection which could be related to the bright umbral dots that appear in high-resolution images of sunspots. Previous two-dimensional calculations have revealed fully localized states and these numerical experiments have now been extended into three dimensions to provide an idealized model of thermally driven convection in the presence of a strong imposed vertical magnetic field. By starting from a flux-separated state, where the domain splits into two regions, one with strong fields and weak convection and the other with vigorous convective plumes and weak fields, and rapidly increasing the imposed field strength, it is possible to create fully localized states, with a single isolated plume from which magnetic flux has been expelled. Typically the large plumes remain as isolated convecting regions but over long times they eventually decay. — NIGEL WEISS.

SUMMARY OF THE RAS NAM DISCUSSION MEETING ON LATE STAGES OF STELLAR EVOLUTION

Four talks given at this session on 2004 April 1 examined the late stages of evolution of intermediate-mass stars during the asymptotic-giant-branch (AGB) phase, high-mass stars as supernovae, and compact remnants. Two speakers incorporated aspects of galactic chemical evolution in their discussions.

Jonathan Marshall (Keele) reported on the derivation of the speed of the superwind from the OH maser emission originating in the outflow from dust-enshrouded AGB stars. This results from the detection of five new OH/IR masers in the LMC, which brings the total number known in the LMC to nine. Substantial differences are seen in the flux from the approaching and receding surfaces of the shell. There is little evidence for a relationship between metallicity and mass loss; however, the derivation of mass-loss rate depends upon outflow wind velocity, which depends on metallicity.

Maggie Hendry, Justyn Maund, and John Eldridge (IoA, Cambridge) considered observational and theoretical aspects of the type-II-P supernova, SN2003gd. *HST* and *Gemini* images taken before the explosion show that the progenitor was an $8_{-2}^{+4} M_{\odot}$ red supergiant, the first such progenitor detected, even though this is the most common type of supernova. A low Ni mass was inferred from the light curve, but this is consistent with the low progenitor mass. SN2003gd, falling close to the lower mass boundary for SN II production, therefore had a Ni mass intermediate between those of normal higher-mass progenitors and low-yielding higher-mass progenitors.

Although AGB stars dominate dust production in the Milky Way, *SCUBA* observations show that substantial quantities of dust exist even at high redshift ($z > 5$) where AGB contributions are not expected to be sufficient over the short ages of the objects. Consequently the evolutionary end-points of faster-evolving massive stars, *i.e.*, supernovae, are suspected to be the source. Haley Morgan (Cardiff) presented measurements of the dust content of the Cas A and Kepler supernova remnants, derived from fits to the submillimetre spectral-energy distribution. Dust masses in the range $2\text{--}4 M_{\odot}$ and $0.3\text{--}3 M_{\odot}$, respectively, were inferred, and make it feasible that the high-redshift observations can be explained from production by massive stars.

Many sites have been suggested for the production of r-process elements, among them lower-mass ($8\text{--}10 M_{\odot}$) core-collapse supernovae, higher-mass core-collapse supernovae ($\geq 20 M_{\odot}$), and neutron-star mergers. Dominik Argast (Basel) presented galactic chemical-evolution models which track the production of neutron-capture elements, to compare scenarios. Due to the lack of reliable yields as a function of progenitor mass, it is not yet possible to distinguish between the lower-mass and higher-mass supernovae scenarios, but neutron-star mergers seem to be ruled out as the *dominant* r-process source. Their low rates of occurrence would lead to too little r-process enrichment compared with observations at low metallicities. Additionally, the considerable production of r-process material by a single neutron-star merger leads to a scatter in [r-process/Fe] ratios at later times, which is not observed. Due to considerable theoretical uncertainties, it remains to be seen how core-collapse supernovae can actually produce the required r-process yields. — SEAN RYAN.

SUMMARY OF THE RAS NAM DISCUSSION MEETING ON

MAGNETIC FIELDS IN CIRCUMSTELLAR ENVIRONMENTS

Magnetic fields play an important rôle in the evolution of circumstellar matter, ranging from star formation and outflows from young stars, to Be stars and the superwind of asymptotic-giant-branch (AGB) stars and red supergiants. Both theoretical and observational developments were presented by Tom Hartquist, Li Qingkang, Jane Greaves, Phil Lucas, Rachel Curran, Jim Cohen, and Anita Richards. An exciting development in this field is the possibility of mapping the three-dimensional distribution of the magnetic field.