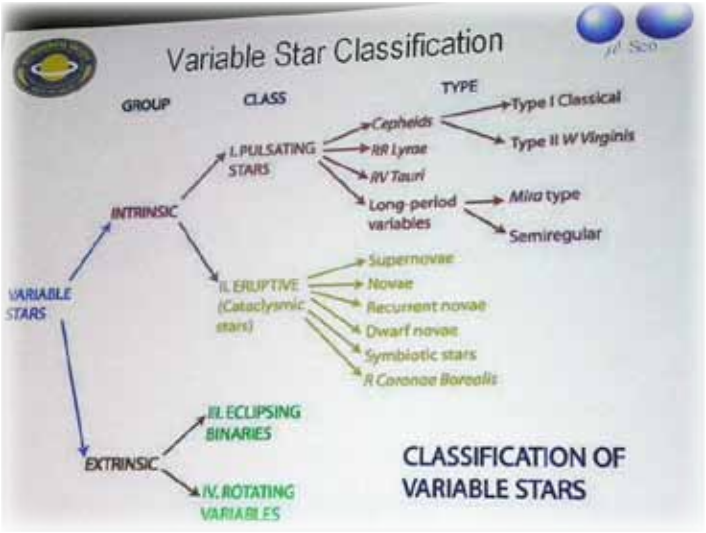
New Observations on μ1 Scorpii

A report on a talk with that name by Dr Terry Moon, Astronomy Society of South Australia

Twice a year, as part of a system to keep in touch and up-to-date with sister astronomical societies, guest speakers are exchanged between the ASV and the ASSA organisations. Barry Adcock, ASV President, welcomed Terry Moon, whose previous visit to the ASV was in 2005, when he spoke of the science of photometry in general, and in particular observing Semi-regular Red Variable Stars.



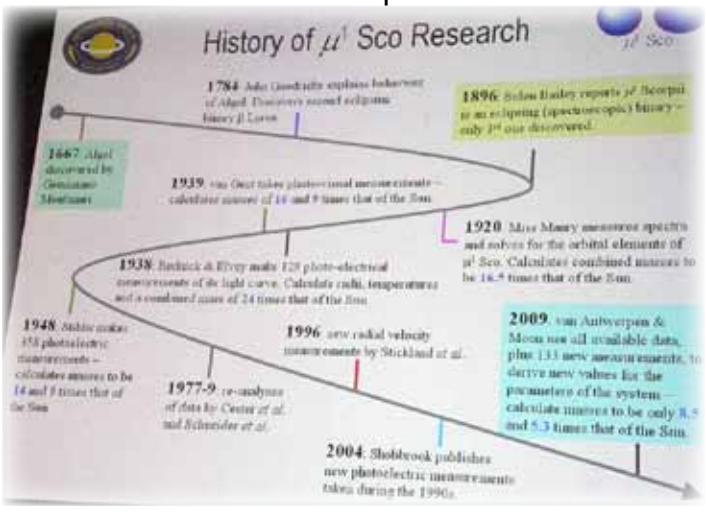
I still cherish the advice he passed on to us then (when things started to get very technical) "... if all this sounds complicated to you, look on the bright side, the magnitude scale may be unnecessarily complicated and awkward, but once you have learned it, you have a valuable tool that turns all those strange astronomical numbers into meaningful information."

That's what astronomy, or astrophysics is really all about. Isn't it? Making use of, making sense of every bit of astronomical information collected from the stars and turning it into meaningful information.

Even Terry's tie reflects his astronomical inclination and his commitment to details.

Starting the presentation with a few snapshots of his observatories, Terry certainly impressed me with his meticulous methods of record-keeping of all the costs involved in the set-up.

His love for, and attention to details became a hallmark for the rest of the presentation.

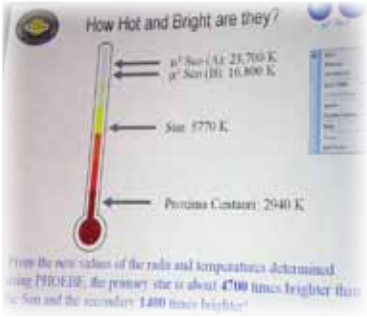


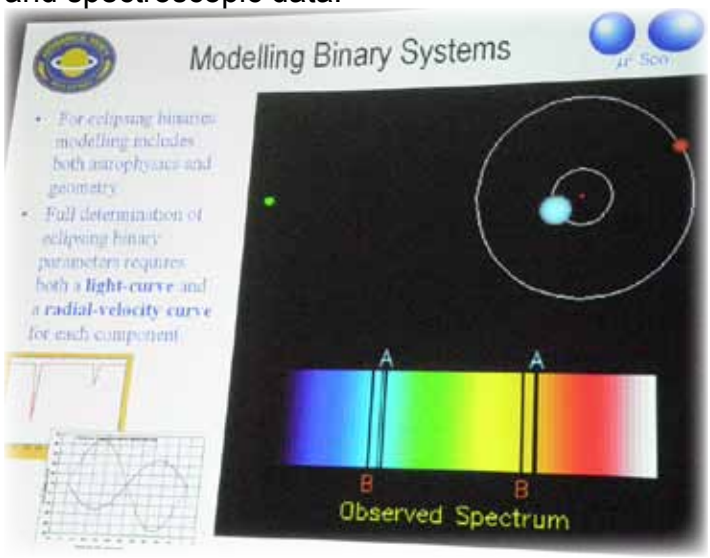
Eclipsing binaries like μ1 Scorpii are really laboratories for determining a number of astronomical data, such as the orbital elements of their compo-

nent stars, stellar masses, relationship between mass and luminosity, and are another means to gauge the distances to galaxies.

Modelling includes both astro-physics and geometry and a full determination of parameters requires both a light-curve and a radial velocity curve for each component.

A new software package called PHOEBE has been developed for this, based on the Wilson-Devinney code. "PHOEBE" stands for Physics of Eclipsing Binaries: a program that uses real photometric and spectroscopic data.

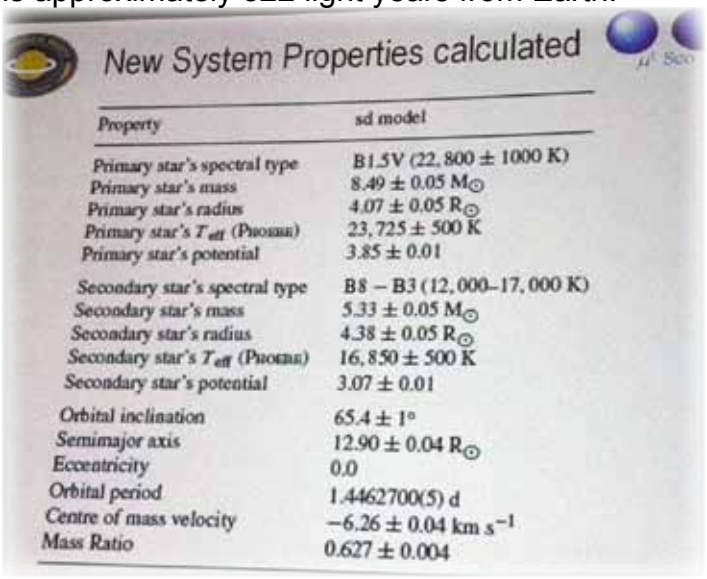




It considers stars as a series of surface elements, calculating how each element contributes to the number of photons transmitted and can be used to detect atmospheric darkening. Using the Roche Model principle of equi-potential surfaces it allows determination of physical characteristics such as star shape and orbit.

In Greek mythology, Phoebe (meaning "radiant and shining") was one of the original 12 Titans (offsprings of Uranus and Gaia) and is traditionally associated with the moon. She had two daughters, Leto and Asteria (the star-goddess).

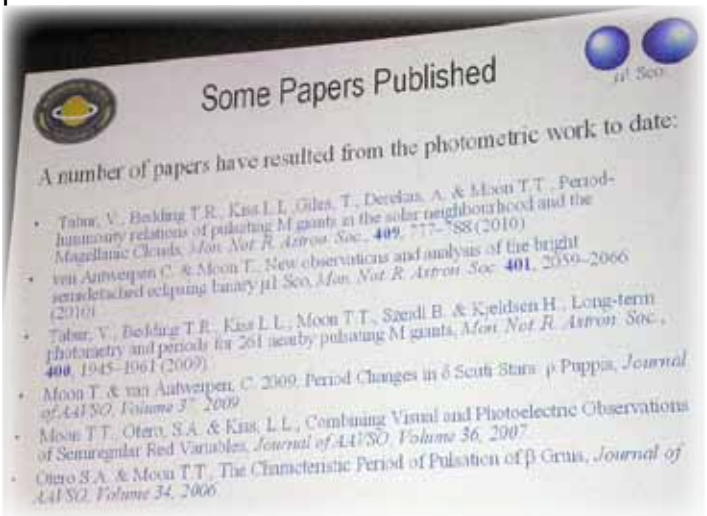
The Wikipedia website for μ¹ Scorpii can be accessed with .../Mu1_Scorpii and describes it as '...an eclipsing binary of the Beta Lyrae type in the constellation Scorpius. Both components are blue-white B-type stars. The primary is a subgiant, while the companion is a cooler dwarf. Due to occultation of the primary by the dimmer companion, the apparent magnitude of the system varies from +2.80 to +3.08 over the course of the binary's orbit, which takes 1.4402 days to complete. The system is approximately 822 light years from Earth.'



Property	sd model
Primary star's spectral type	B1.5V (22,800 ± 1000 K)
Primary star's mass	8.49 ± 0.05 $M_\odot$
Primary star's radius	4.07 ± 0.05 $R_\odot$
Primary star's T_{eff} (Phoebe)	23,725 ± 500 K
Primary star's potential	3.85 ± 0.01
Secondary star's spectral type	B8 – B3 (12,000–17,000 K)
Secondary star's mass	5.33 ± 0.05 $M_\odot$
Secondary star's radius	4.38 ± 0.05 $R_\odot$
Secondary star's T_{eff} (Phoebe)	16,850 ± 500 K
Secondary star's potential	3.07 ± 0.01
Orbital inclination	65.4 ± 1°
Semimajor axis	12.90 ± 0.04 $R_\odot$
Eccentricity	0.0
Orbital period	1.4462700(5) d
Centre of mass velocity	−6.26 ± 0.04 km s^{-1}
Mass Ratio	0.627 ± 0.004

μ¹ Scorpii is the Bayer designation for the system; other alternate names / designations are: Denebakrab, HR 6247, HD 151890, CD-37°11033, FK5 1439, HIP 82514, SAO 208102 and GC 22677.

As a parting comment (another affirmation of his attention to details) Dr Terry Moon reminded us how vital purposive record keeping is to research and for publications. You can see some of his publications in the list below:



The PHOEBE program can be found on http://phoebe.fiz.uni-lj.si/; it is both free of charge and free in a sense that you may re-use its code in any way you see fit, as long as your product remains free also, released under the General Public License. AK