moved from the typical dispersion values employed in qualitative stellar spectroscopy to higher values, principally obtained with the coude instruments. These have given us the crude first results in our efforts to get at quantitative values of stellar parameters. We have progressed little beyond this stage of coarse study, with little information available on line profiles other than of the Balmer series. Resolutions have hitherto been employed for "fine" analysis of stars that we have seldom used even in our first studies of the solar atmosphere. The restraint has not come from the lack of means to achieve such a resolution. It has probably originated from the subconscious tendency that we have always had in stellar research that a technique when adopted must be capable of extension to several stars of different faintness.

The brightest stars in the sky, at least the ten brightest ones, can profitably be studied by techniques of very high resolution. Amongst themselves they cover a range in spectral type and luminosity that provides a variety of greatest interest to theoretical interpretation. It should be our aim to attempt on these stars the standards of precision that is the common byword in line profile measures made today in solar reserach. Line profiles, with low scattered light-contamination levels as are obtained with monochromators in tandem or grating spectrometers employed in the double pass mode, should usher in sophistications in theoretical interpretation with realistic boundary conditions. The developments in our interpretative approach of stellar atmospheres of the next decade will undoubtedly depend heavily on the availability of such information.

To sum up, I believe that we find ourselves in possession of a repertoire of facilities that keep us poised on the threshold of major break-throughs in measurement and interpretation in the field of stellar spectroscopy. The future is splendidly bright and holds forth immense promise of vistas of accomplishment in this fascinating area of the study of electromagnetic radiation from the stars.

(Delivered on 27 February 1974)

Report on the Fifth Lunar Conference

The Fifth Annual Lunar Science Conference was held at the Johnson Space Center, Houston, March 18-22, 1974. Being the first post-Apollo conference, it distinguished itself from the previous meetings by a transition from a mission oriented data reporting to a problem oriented research. Consequently, several myths, generally accepted before, could not sustain the crucial scientific enquiries. Most noteworthy was the discovery of early condensates in the 4.6 billion year old lunar rock, a dunite breccia, which pushed the lunar history back by at least 400 million years and together with the simultaneous discovery of several 4.2 billion year rocks brought the 3.9 billion year "Lunar Cataclysm" earlier postulated by the Caltech group, to some question. The same group from Caltech showed that the generally accepted belief that most meteorites have a "magic age" of 4.6 billion years is not true by showing two lithic fragments in achondrite Kapoeta to be only 3.6 and 3.9 billion years old and Nakhla only 1.3 billion years old. Both these meteorites were taken to be very old, having been shown to contain primitive Pu^{244} fission xenon. In addition, Kapoeta, containing track and gas rich grains, irradiated before compaction of the meteorite body, should now be taken as a proof that compaction of meteorite bodies is a continuing process in the solar system. Essentially, these results brought the lunar and meteorite chronologies to a serious revision.

Like the ages, earlier conclusions about lunar structure was also questioned. The consensus was in favour of an inner 700 km radius core (asthenosphere) close to its melting temperature, a surrounding 1000 km shell of mantle material and the top 60-100 km thick crust of the moon, the upper 20 km being the basaltic material. Sources of various exotic components on the lunar surface were identified as follows: Anorthosites up to 40 km, KREEP source at 60 km, high aluminium mare basalt—100 km, high titanium basalts—150 km, Apollo 12-15 type basalts 250 km, source of green glass—300 km.

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There were many interesting results on lunar chemistry. Allende, a recently fallen carbonaceous chondrite, figured prominently for its similarity of high temperature condensates to the moon. Chemical models for bulk chemistry of the moon were presented, suggesting that bulk moon was made of 50 per cent chondritic component and 50 per cent Allende type high temperature phase as against 84: 16 for earth. Bulk composition of moon was inferred in per cent, to be O : 40, Mg : 10.1, Al : 9.1, Si : 14.9, Ca : 9.7, Ti : 0.5, Fe : 13 etc. Minerals cordiorite and ferringtonite were found for the first time in the moon. Formation of moon was favoured in terms of homogeneous accretion and its capture within earth's Roche limit by a systematic analysis of various samples. Chicago group attempted to chemically characterize the projectiles which formed the major mare.

A considerable emphasis was given to the development of regolith on the moon. Dollfus presented evidence based on optical reflectivity and polarization that many planets and Jovian satellites contain well developed regolith—some, specially Mercury, similar to moon, and others similar to carbonaceous chondrites. Several surface correlated phenomenon like micrometeoroid craters, solar wind and solar flare records were used to label the material exposed on the lunar surface and then identified to deduce mixing and transport of material on the moon. The results generally supported the deposition model earlier postulated by Bombay and La Jolla groups that deposition is faster than mixing. Gault revised his earlier calculation, now concluding that mixing is limited to the top millimetre of lunar surface. Evidence of solar hydrogen, nitrogen, carbon and sulphur implantation on lunar grain surfaces was found. Results of IIT (Kanpur) indicated a significant nitrogen in lunar soil of solar origin.

Several results were presented bearing on variation of micrometeorite influx rate, solar flare particles and galactic cosmic rays. The Physical Research Laboratory (Ahmedabad) presented data showing similarity of cosmic ray composition in the remote past. There was evidence of a higher micrometeorite influx rate in the remote past (≈ 3 b.y.) as well as very recent past (10^4 years) relative to solar flare intensity. Battelle group showed anisotropy between high and low energy solar flare nuclei (from August 72 flare) from the induced isotopic effects.

Evidence of the "anomalous" terrestrial type xenon isotopic ratios in old lunar breccias indicated that the earth and moon, both should have obtained their primitive xenon from a common source. Since isotopic composition of terrestrial xenon remains unexplained on the basis of known processes of fractionation, this is an important observation.

Following the conference, there was a session on Apollo Astronomical experiments and their cosmological importance. Observations on gamma ray bursts, low energy solar plasma around the moon and study of geocorona were presented.

In all, a wide variety of subjects were covered at this conference, which brought several interdisciplinary studies together and was very stimulating.

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The regions of negative dissipation decrease as we go from hydrogen-burning models to helium-burning models. Higher overtones are more stable than the fundamental. For comparison, these studies have been extended to 5, 9, 15 $M_\odot$ models belonging to the helium burning phase. There is an overall agreement with the above results for the adiabatic characteristics. Results for the outer layers, corresponding to Kramer's opacity with helium-hydrogen ratio equal to 0.15, give stable models, whereas we get spurious results for various values of n and s when we use the original helium-hydrogen ratio (B=0.272/0.708).