Stromlo. The first, with 5–6 Å resolution and covering the range 3400 to 6800 Å, is of star 14 and is widened 0.3 mm. The second is not widened and, with an entrance slit width of 2.1 arc s, was guided to lie between stars 14 and 15. Deterioration of the seeing from roughly 1.5 arc s to 3 arc s during this exposure resulted in contamination of the spectrum by some light from stars 14 and 15. The spectrum of star 14 is shown in Fig. 1. It is roughly of spectral type F8V–G5V and there is no emission or any other peculiarity which might suggest a source of high thermal or non-thermal excitation. The unwidened spectrum shows no emission, but the light of star 14 dominates the spectrum. I conclude that star 14 is not the source of GX3+1 X-ray emission and that star 15 is probably not the source of this radiation. There is no evidence of line emission in the region between stars 14 and 15. It is ironic that a previous search[4] for an optical candidate for GX3+1 based on poor X-ray position data revealed a star which, with strong emission features showing excitation temperatures of about 500,000 K, is an *a priori* candidate as an emitter of soft thermal X-rays.

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Remanent Magnetization in Meteorites

ALTHOUGH the existence of natural remanent magnetization in meteorites has been taken as evidence for a primaeval magnetic field in the original bodies—presumably of asteroidal dimensions—from which meteorites formed[1], it seems surprising that an asteroidal core (~ 100 km diameter as an upper limit) can sustain convective motions efficient enough to produce the magnetic field, $\sim 10^{-1}$ to 1 G, required by the NRM measurements[2]. Moreover, recent data suggest that iron meteorites are not necessarily fragments of a much larger core, as had been supposed, but formed as small bodies embedded in a silicate matrix[3]. As there is no other obvious internal mechanism for generating NRM, could an external mechanism be responsible? During the early history of the solar system, the magnetic field of the Sun may have been much more intense than it is at present, possibly ~ 100 G (ref. 4), and the rotation of the Sun may have been much more rapid. A recent estimate for solar spin damping by the solar wind gives an e-folding time $\sim 2.2\times 10^{9}$ yr (ref. 5). There are two mechanisms by which NRM could have been created in meteorites under these conditions.

First, the enhanced magnetic field and rotation rate of the early Sun imply a very greatly increased flux of magnetic induction in the ecliptic plane, which can lead to large-scale flows of current in bodies moving in this plane[6] and so to the production of magnetic fields up to ~ 1 G. Solid material placed in the field will normally acquire only a soft isothermal component of NRM, but this can be fixed in small objects, or surface material, by the interplanetary neutron flux[7] Alternatively, if the material involved was initially molten, then cooled through its Curie point, NRM might be acquired in the usual way; but the sector nature of the interplanetary field could prevent this.

The second magnetization process depends on the occurrence of high-velocity (~ 5 km s^{-1}) collisions between asteroidal bodies, such as probably generated the meteoroidal fragments. These impacts can produce vaporization of the bodies in the area of contact, together with shock effects and fragmentation throughout a much larger region. A plasma is produced, which is momentarily compressed by the continuing motion of the remaining parts of the bodies. For two asteroidal bodies moving with typical cosmic velocities, the compression factor may be ~ 10–100. If the interplanetary magnetic field is frozen into the plasma generated, compression increases the magnetic field intensity between the two bodies. In the early solar system, a magnetic field $\sim 10^{-1}$ to 1 G could be produced briefly during a collision at 1 AU from the Sun. (This ignores the possibility of any further amplification of the magnetic field by dynamo-type effects during the collision.)

Can a short-lived magnetic field in the order of a few seconds duration produce NRM in the collisional fragments? Meteorite NRM resides in the iron–nickel fraction, and could be induced if the Curie temperature of this fraction was exceeded during the brief collisional enhancement of the magnetic field. The collision must generate a shock wave (a relative velocity of 1 km s^{-1} leads to a shock pressure ~ 130 kbar (ref. 8)). Most meteorites have been subject to at least moderate shock[9], but estimated temperatures suggest that the Curie point of iron would only be exceeded for heavily shocked specimens. Laboratory experiments indicate, however, that iron–nickel alloys have a pressure-sensitive Curie point, so that both peak pressure and peak temperature may be important (see ref. 10). The iron–nickel ratio in meteorites varies (for example, in the kamacite–taenite diffusion borders[11]), so that some effect of shock on the Curie point seems inevitable. (The greatest values of NRM for meteorites occur for the group of iron meteorites with the highest proportion of nickel[12].) Because the Curie-point transition is related to the passage of the shock wave, its duration is appropriately brief ($\lesssim 1$ s). The passage of the shock can have an ordering effect on magnetic domains, so that NRM production by shock may be more efficient than straightforward cooling through the Curie point.

The methods of producing NRM described here could also apply to the Moon. In the case of impact-produced NRM, the depth below the crater to which material may be affected is $\sim 1/10$ of the crater diameter[13]. Ejected material would, of course, show NRM in a similar manner to meteorites.

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