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THE BEHAVIOUR OF THE OUTER SOLAR CORONA ($3\,R_\odot$ TO $10\,R_\odot$) DURING A LARGE SOLAR FLARE OBSERVED FROM OSO-7 IN WHITE LIGHT

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Abstract (*Solar Phys.*). A very bright coronal streamer was observed on December 13, 1971 by the Naval Research Laboratory's coronagraph on board of OSO-7. The next day, the streamer had changed it's brightness and configuration considerably. Three subsequent coronagraph images, taken on December 14 at 0407, 0418 and 0430 UT show a large plasma cloud moving outward from the Sun between 3 and 10 solar radii. They also show distinct smaller clouds moving outward with projected velocities between 950 and 1100 km s^{-1}. Traced back in time to the lower solar corona, these clouds coincide with discrete type II radiobursts observed from Culgoora between 0241 and 0256 UT. Each single cloud shows it's signature in the radio recording between 100 and 20 MHz. The drift velocity of the radio bursts can be determined to be 1600 km s^{-1} using Newkirk's coronal streamer model. Assuming, that the plasma clouds are ejected from an active region 30° behind the east limb vertically, their true velocities close to the surface of the Sun would be approximately 1400 km s^{-1}, which is in good agreement with the drift velocities determined from the type II bursts, considering all uncertainties. Therefore, the type II burst disturbance moves with the same velocity as the driving material.

The total coronal blast contains a number of particles of more than 2.5×10^{40} with a total energy of greater than 1×10^{32} erg. At 8 solar radii the disturbance lasts approximately 2.5 h.

A considerable fraction of the total energy can be found in the discrete, high velocity clouds. They carry more than 1.6×10^{31} erg.

After the event, on December 15, only a very weak remnant of the original streamer can be found. Estimates show, that the total mass contents of the streamer configuration was more than 2×10^{40} particles prior to the event. It is therefore possible to obtain the total mass of the coronal blast by emptying the preflare streamer configuration.

DISCUSSION

Dryer: I believe that you caught the birth of at least one (probably more) shock. This seems to be attested to by the type II velocities which are close to the values measured by your clouds. Thus, as time goes on, the shock, originally formed at the piston – in theory at least – would move ahead of the driving plasma piston. In reality (laboratory and detailed analysis) some time is required for the shock to form. I hope that Dr N. Krall will discuss this point this afternoon.

Smith (to Dryer): How do you determine the stand-off distance of the shock from such a small blob? Isn't it possible that the standoff distance is quite small?

Gordon Newkirk, Jr. (ed.), Coronal Disturbances, 333–334. *All Rights Reserved.*

Dryer: Yes, you expect the shock and piston (blob) to be initially coincident and the shock to accelerate and move away from the piston.

Schmidt: The fast blobs you discribe can certainly drive the type II, but they do not contain sufficient mass to drive an interplanetary shock. Therefore, these two phenomena do not necessarily outline the same shockfront. An interplanetary shock may well develop from the larger masses you were describing.

Brueckner: One of my slides shows the small fast clouds and the type II bursts associated with them. However, most of the material moves at 600 to 700 km s^{-1} and this may be associated with the interplanetary shock. This interpretation agrees with the onset time of the Forbush decrease. There were about 10^{32} ergs and 10^{16}–10^{17} g involved.

Schmidt: I assume that the velocities of the larger masses are rather hard to measure. But even if these masses do not move so fast, they will produce an interplanetary shock, if they are slightly hotter than the corona before the event. There is ample time for the interplanetary shock to develop after the flare and to reach 1 AU within the observed travel time.