Abstract. The amount of solar wind absorption due to charge-exchange in the Martian magnetosheath is evaluated and found to be about an order of magnitude less than that in the Venus magnetosheath. This difference might explain the observed difference in the scaled position and shape between the shocks at Venus and Mars. The lower solar wind absorption for Mars is attributable to the less dense hot oxygen corona of Mars compared to Venus.

Both Venus and Mars present obstacles to the solar wind flow that are fractionally larger than the size of the solid planet. Thus, the solar wind can interact directly with the ionospheres and with the extended neutral upper atmospheres of these planets. Two processes are possible. Photoionization of the neutrals adds mass to the flow. Charge-exchange between the solar wind ions and the neutral atmosphere removes momentum from the plasma flow by creating fast neutrals which are not deflected by the ionospheric obstacle. Symmetric charge-exchange, i.e., protons with hydrogen, does not add mass to the flow (Nagy, 1973). However, Venus has a hot oxygen corona in addition to its hydrogen corona (Nagy et al., 1981) and charge-exchange between protons and oxygen is accidentally resonant. Thus, charge-exchange with the Venus hydrogen and oxygen coronas will both remove momentum and add mass to the flow.

Wind tunnel experiments on supersonic flows show that the addition of mass to the flow in front of the obstacle, but behind the shock, causes the shock to move away from the obstacle (Cresci and Libby, 1962). This occurs because of the greater mass flux that has to move around the obstacle. Thus, both photoionization of and charge-exchange with the Venus exosphere should lead to a shock that, at least at the terminator, is larger than would occur in the absence of such effects. On the other hand, the momentum loss to fast neutrals in the charge-exchange process reduces the amount of deflection of the solar wind required of the bow shock. The gasdynamic analogy of this is the slender cone obstacle. The more slender the cone, the less deflection occurs and the shock moves towards the obstacle at the sub-point, in the limit being attached to the nose of the body. Combining these two effects, we would expect charge-exchange and photoionization to lead to a smaller nose standoff distance and a greater terminator crossing distance for the Venus bow shock.

One of the intriguing questions about Mars, that is still quite controversial, is whether it has an intrinsic magnetic field (cf. Dolginov, 1978a,b; Russell, 1978a,b). One might hope to use the position of the bow shock to place limits on the size of the intrinsic magnetic moment of Mars. This has been done by various authors (cf. Russell, 1978b; Slavin and Holzer, 1982). However, since momentum removal and mass addition can alter the position and shape of the shock, it is important to evaluate the effects of these processes at Mars as has been done at Venus. It is the purpose of this note to repeat, for Mars, the computations of Gombosi et al. (1981) which were performed for Venus. As before we use streamlines that are an analytical fit to those used by Stahara et al. We repeated for Mars the same type of hot oxygen corona calculations that we earlier performed for Venus (Nagy et al., 1981). We found that the oxygen densities on Mars are over a factor of ten lower than on Venus, primarily because ionospheric densities are lower on Mars than on Venus. Dissociative recombination of O\textsuperscript{+} is the main source of hot O. On Venus, this hot oxygen exosphere was responsible for most of the solar wind absorption except for very low ionopause heights when the cold atmosphere plays a role (Gombosi et al., 1980). The lack of a substantial hot oxygen corona on Mars will strongly affect the amount of solar wind absorption there.

Figure 1 shows for both Mars and Venus the calculated total normalized absorption above a given flow line characterized by the altitude at which it crosses the terminator. For the same terminator altitude the absorption is much greater at Venus. At low terminator altitudes (~250 km) the difference is about a factor of 5. At higher altitudes the difference is even greater, increasing to a factor of about 15 at 400 km. Thus, charge-exchange is not as important at Mars as it is at Venus. The results shown in Figure 1 indicate that the gasdynamic analog used to model the interaction of the solar wind, which does not include mass-loading, is more appropriate for Mars than for Venus. However, they also provide a caution-
Fig. 1. Percent absorption of solar wind protons through charge-exchange at Venus and Mars for streamlines which at infinity are within one planetary radius of the sun-planet line. Absorption is plotted versus altitude at the terminator of the lowest streamline.

any note for inferences about the nature of the Martian obstacle to the solar wind from our Venus observations. In fact, the differences reported in the position and shape between the Venus and Mars shocks (Slavin and Holzer, 1981), i.e., the larger standoff distance and relatively smaller terminator crossing distance, are in the direction that would be predicted by the differences in the amount of charge-exchange in the two magnetosheaths. However, it remains for future analysis, for example by adding non-gasdynamic effects to the gasdynamic codes, to see if the difference can be quantitatively explained.

Acknowledgments. The authors gratefully acknowledge many useful comments on this work by L. H. Brace, D. M. Hunten, J. R. Spreiter and S. Stahara. This material is based upon work supported by the National Sciences Foundation under Grants No. ATM-8210691 and INT-8026015 and by the National Aeronautics and Space Administration under Grants No. NAGW-15 and NGR23-005-015.

Acknowledgement is also made to the National Center for Atmospheric Research, which is sponsored by the National Science Foundation, for the computing time used in this research.

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(Received November 1, 1982; accepted November 24, 1982.)