

Acknowledgements

We thank Carolyn Ernst for helpful comments that improved an earlier version of this manuscript. The MESSENGER project is supported by the NASA Discovery Program under contracts NASW-00002 to the Carnegie Institution of Washington and NAS5-97271 to the Johns Hopkins University Applied Physics Laboratory.

References

- Cook, A.C., Robinson, M.S., 2000. Mariner 10 stereo image coverage of Mercury. *J. Geophys. Res.* 105, 9429–9443.
- Giese, B., Oberst, J., Roatsch, T., Neukum, G., Head, J.W., Pappalardo, R.T., 1998. The local topography of Uruk Sulcus and Galileo Regio obtained from stereo images. *Icarus* 135, 303–316.
- Giese, B., Neukum, G., Roatsch, T., Denk, T., Porco, C.C., 2006. Topographic modeling of Phoebe using Cassini images. *Planet. Space Sci.* 54, 1156–1166.
- Gwinner, K., Scholten, F., Spiegel, M., Schmidt, R., Giese, B., Oberst, J., Jaumann, R., Heipke, C., Neukum, G., 2009. Derivation and validation of high-resolution digital terrain models from Mars Express HRSC-data. *Photogramm. Eng. Remote Sensing* 75, 1127–1142.
- Gwinner, K., Scholten, F., Preusker, F., Elgner, S., Roatsch, T., Spiegel, M., Schmidt, R., Oberst, J., Jaumann, R., Heipke, C., 2010. Topography of Mars from global mapping by HRSC high-resolution digital terrain models and orthoimages: characteristics and performance. *Earth Planet. Sci. Lett.* 294, 506–519.
- Hawkins III, S.E., Boldt, J.D., Darlington, D.H., Espiritu, R., Gold, R.E., Gotwols, B., Grey, M.P., Hash, C.D., Hayes, J.R., Jaskulek, S.E., Kardian Jr., C.J., Keller, M.R., Malaret, E.R., Murchie, S.L., Murphy, P.K., Peacock, K., Prockter, L.M., Reiter, R.A., Robinson, M.S., Schaefer, E.D., Shelton, R.G., Sterner II, R.E., Taylor, H.W., Watters, T.R., Williams, B.D., 2007. The Mercury Dual Imaging System on the MESSENGER spacecraft. *Space Sci. Rev.* 131, 247–338.
- Hawkins III, S.E., Murchie, S.L., Becker, K.J., Selby, C.M., Turner, F.S., Nobel, M.W., Chabot, N.L., Choo, T.H., Darlington, E.H., Denevi, B.W., Domingue, D.L., Ernst, C.M., Holsclaw, G.M., Laslo, N.R., McClintock, W.E., Prockter, L.M., Robinson, M.S., Solomon, S.C., Sterner II, R.E., 2009. In-flight performance of MESSENGER's Mercury Dual Imaging System. In: Hoover, R.B., Levin, G.V., Rozanov, A.Y., Retherford, K.D. (Eds.), *Instruments and Methods for Astrobiology and Planetary Missions*. SPIE Proceedings, vol. 7441. SPIE, Bellingham, Wash, pp. 12 (paper 7441A-3).
- Oberst, J., Preusker, F., Phillips, R.J., Watters, T.R., Head, J.W., Zuber, M.T., Solomon, S.C., 2010. The morphology of Mercury's Caloris basin as seen in MESSENGER stereo topographic models. *Icarus* 209, 230–238.
- Scholten, F., Gwinner, K., Roatsch, T., Matz, K.-D., Wählisch, M., Giese, B., Oberst, J., Jaumann, R., Neukum, G., Team, Co-Investigator, 2005. Mars Express HRSC data processing—methods and operational aspects. *Photogramm. Eng. Remote Sensing* 71, 1143–1152.
- Slade, M.A., Jurgens, R.F., Rojas, F., 1997. New radar topography of Mercury and the need for a Mercury DTM. *Lunar Planet. Sci.* 28 (abstract 1333).
- Smith, D.E., Zuber, M.T., Phillips, R.J., Solomon, S.C., Neumann, G.A., Lemoine, F.G., Peale, S.J., Margot, J.-L., Torrence, M.H., Talpe, M.J., Head III, J.W., Hauck II, S.A., Johnson, C.L., Perry, M.E., Barnouin, O.S., McNutt Jr., R.L., Oberst, J., 2010. The equatorial shape and gravity field of Mercury from MESSENGER flybys 1 and 2. *Icarus* 209, 88–100.
- Solomon, S.C., McNutt Jr., R.L., Watters, T.R., Lawrence, D.J., Feldman, W.C., Head, J.W., Krimigis, S.M., Murchie, S.L., Phillips, R.J., Slavin, J.A., Zuber, M.T., 2008. Return to Mercury: a global perspective on MESSENGER's first Mercury flyby. *Science* 321, 59–62.
- Watters, T.R., Cook, A.C., Robinson, M.S., 2001. Large-scale lobate scarps in the southern hemisphere of Mercury. *Planet. Space Sci.* 49, 1523–1530.
- Watters, T.R., Solomon, S.C., Robinson, M.S., Head, J.W., André, S.L., Hauck II, S.A., Murchie, S.L., 2009a. The tectonics of Mercury: the view after MESSENGER's first flyby. *Earth Planet. Sci. Lett.* 285, 283–296.
- Watters, T.R., Head, J.W., Solomon, S.C., Robinson, M.S., Chapman, C.R., Denevi, B.W., Fassett, C.I., Murchie, S.L., Strom, R.G., 2009b. Evolution of the Rembrandt impact basin on Mercury. *Science* 324, 618–621.
- Wewel, F., 1996. Determination of conjugate points of stereoscopic three line scanner data of Mars 96 mission. *Int. Arch. Photogramm. Remote Sensing* 31, 936–939.
- Zuber, M.T., Smith, D.E., Solomon, S.C., Phillips, R.J., Peale, S.J., Head III, J.W., Hauck II, S.A., McNutt Jr., R.L., Oberst, J., Neumann, G.A., Lemoine, F.G., Sun, X., Barnouin-Jha, O., Harmon, J.K., 2008. Laser altimeter observations from MESSENGER's first Mercury flyby. *Science* 321, 77–79.