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Shock Wave and Fracture Propagation in Water Ice by High Velocity Impact MASAHIKO ARAKAWA, Institute of Low Temperature Science, Hokkaido University, KEI SHIRAI, MANABU KATO, Institute of Space and Astronautical Science — In order to clarify the elementary processes of impact disruption, we made impact experiments of water ice at the impact velocity of 3.6 km/s and conducted simultaneous observation of shock wave and fracture propagation in it by means of ultra-high speed photography. We observed a spherical shock wave propagating with the velocity of 4.4-3.5 km/s from the impact point and a reflection wave from the free surfaces. A region in which HEL (Hugoniot elastic limit) followed the elastic precursor wave, expanded with a velocity of 3-2.5 km/s until the pressure fell below 240 MPa. Below that pressure, a damage region appeared after 0.8-3 μs of the passage of precursor wave. In this region, dynamic shear strength of water ice was estimated to be 21 MPa. At the front of damage region, a wavy feature appeared and grew up radial cracks. Below 80 MPa, the several radial cracks proceeded toward the rear surface and broke the sample before tensile fracture caused by reflection waves from an antipodal point became visible. Therefore, the main mechanism to make the largest fragment is considered to be the radial crack growth rather than a spallation at the rear.

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