The primary goal of the HMI investigation is to study the origin of solar variability and to characterize and understand the Sun's interior and the various components of magnetic activity.

HMI will:
1. Make measurements of the motion of the solar photosphere to study solar oscillations.
2. Make measurements of the polarization in a spectral line to study all three components of the photospheric magnetic field.
3. Produce data to determine the interior sources and mechanisms of solar variability and how the physical processes inside the Sun are related to surface magnetic field and activity.
4. Produce data to enable estimates of the coronal magnetic field for studies of variability in the extended solar atmosphere.

Convection zone dynamics and solar dynamo
• Structure and dynamics of the tachocline
• Variations in differential rotation
• Evolution of meridional circulation
• Dynamics in the near-surface shear layer

Solar rotation: observations vs models
Observations
Numerical model
Variations of meridional flow with cycle

Origin and evolution of sunspots, active regions and complexes of activity
• Formation and deep structure of magnetic complexes
• Active region source and evolution
• Magnetic flux concentration in sunspots
• Sources and mechanisms of solar irradiance variations

Growth and formation of sunspots of AR 10488, October 31, 2003

Large-scale flows around active regions

Observations of twisting motions
August 7, August 8

Ring diagrams and three-dimensional helioseismology have found that the large-scale flows around developed active regions consist of a converging flow of plasma above the neutral line in the upper photosphere and a diverging flow below 9 Mm.

Sources and drivers of solar activity and disturbances
• Origin and dynamics of magnetic sheared structures and delta-type sunspots
• Magnetic configuration and mechanisms of solar flares and CME
• Emergence of magnetic flux and solar transient events
• Evolution of small-scale structures and magnetic carpet
• Fast subphotospheric plasma streams
• 4-6 Mm below the surface and magnetic field quasi-separatrix layers associated with solar flares

Links between the internal processes and dynamics of the corona and heliosphere
• Complexity and energetics of solar corona
• Large-scale coronal field estimates
• Coronal magnetic structure and solar wind

Synoptic map of subphotospheric flows

Precursors of solar disturbances for space-weather forecasts
• Far-side imaging and activity index
• Predicting emergence of active regions by helioseismic imaging
• Determination of magnetic cloud B events

Observing sunspots on the far side of the Sun

Tomographic imaging of emerging active regions