Science Goal	Science Objective	Physical Parameters	Observables	Instrument	Instrument Functional Requirements	Projected Performance	Mission Requirements
Determine whether prebiotic chemical ingredients can be dispersed between stellar systems and the interstellar medium.	Determine whether the ISO contains prebiotic chemical ingredients.	The presence of functional groups of organic matter. PAHs and tholins are particularly interesting for their biological and space weathering implications.	7.4 μm (aliphatic), 12.5 μm (unsaturated), 7–14 μm (PAH), 7.4 μm (oxygen groups), 6.5 μm (nitrogen groups), 7.1 μm (ketones and carbonyl)	Mid-IR spectrometer	5–14 μm spectral range; 0.02 μm spectral resolution; absorptions >1% in reflectance	5–15 μm spectral range; 0.01 μm spectral resolution; absorptions >0.75% in reflectance	0.3 mrad control (to keep object in field of view). Launch within six months of detection of the ISO.
			5.3 μm (tholins)				
			3.2–3.4 μm (C-H), 1.6 and 2.5 μm (O-H), 2.2 μm (N_2)	Near-IR spectrometer	1.6–3.2 μm spectral range; 0.02 μm spectral resolution; absorptions >1% in reflectance	1–4 μm spectral range; 0.01 μm spectral resolution; absorptions >0.75% in reflectance	
		The presence of OH, CH, and N_2 to better than 1% precision.	2.7–2.8 μm (O-H)				
		The abundance of N, P, and S relative to O.	400 nm (N), 254 nm (P), 420 nm (S), 278 nm (O)	UV-visible spectrometer	250–425 nm spectral range; 1 nm spectral resolution; emission >1% continuum	200–600 nm spectral range; 0.4 nm spectral resolution; emission >0.1% continuum	Observe at the beginning of the impact through the first 5 seconds of decay. Impact that can be observed by the remote sensing suite with a minimum energy of Deep Impact.
Determine whether interstellar objects form via the same processes that created objects within our solar system.	Determine whether the ISO formed in an environment with chemical composition similar to our solar system.	Measurement of Δ^{17}O.	312.1 nm (^{16}O), 147.7 nm (^{17}O), 312.1 nm (^{18}O)	UV-visible spectometer	307–317 nm and 146–149 nm spectral ranges; 0.03 nm spectral resolution; emission greater than 0.1% continuum	305–320 nm and 131–151 nm spectral ranges; 0.009 nm spectral resolution; emission greater than 0.1% continuum in echelle channel	Observe at the beginning of the impact through the first 5 seconds of decay. Impact that can be observed by the remote sensing suite with a minimum energy of Deep Impact.
		Atomic abundances to better than 5% precision.	567 nm (Si), 264 and 282 nm (Al), 375 and 238 nm (Fe), 393 and 397 nm (Ca), 314 and 589 nm (Na), 208 nm (K), 518 nm (Mg), 336 and 521 nm (Ti), 403 nm (Mn), 299 nm (Ni)		200–590 nm spectral range; 0.5 nm spectral resolution; emission greater than 1% continuum	200–600 nm spectral range; 0.4 nm spectral resolution; emission greater than 0.1% continuum	
		Relative abundances of noble gases.	588 nm (He), 540 and 585 nm (Ne), 459 and 473 nm (Ar), 557 nm (Kr), and 481 and 492 nm (Xe)		450–590 nm spectral range; 0.5 nm spectral resolution; emission greater than 1% continuum		
	Determine if processes in extrasolar systems lead to bodies similar to those found in our solar system.	Spectral identification of rocks and ices.	1.6, 1.4, 2.0, and 2.7 μm (CO_2 ice); 1.05, 1.3, 1.55, 1.65, 2.0, and 3.1 μm (H_2O ice); 2.0, 2.1, and 3.0 μm (NH_3 ice); 1.0, 1.65, 1.82, and 2.2 μm (CH_4 ice); 2.15 μm (N_2 ice)	Near-IR specrometer	1.0–3.2 μm spectral range; 0.02 μm spectral resolution; absorptions greater than 1% in reflectance.	1–4 μm spectral range; 0.01 μm spectral resolution; absorptions greater than 0.75%	0.3 mrad control (to keep object in field of view). Launch within six months of detection of the ISO.
			1.0 μm (olivine), 2.0 μm (pyroxene), 1.0–1.5 μm (plagioclase)		1.0–2.2 μm spectral range; 0.02 μm spectral resolution; absorptions greater than 1% in reflectance		
			See above relating to the physical parameter "Atomic abundances to better than 5% precision".	UV-visible spectrometer.	See above relating to the physical parameter "Atomic abundances to better than 5% precision"	See above relating to the physical parameter "Atomic abundances to better than 5% precision"	Observe at the beginning of the impact through the first 5 seconds of decay. Impact that can be observed by the remote sensing suite with a minimum energy of Deep Impact.
		Molar abundances of minerals to the 1% precision level.	9.7–10.6 μm (plagioclase)	Mid-IR spectrometer	9.5–10.8 μm spectral range; 0.05 μm spectral resolution; absorptions greater than 1% in reflectance	5–15 μm spectral range; 0.01 μm spectral resolution; absorptions greater than 0.75%	
			9.0–9.8 and 10–12 μm (clinopyroxene)		8.3–10.5 μm spectral range; 0.02 μm spectral resolution; absorptions greater than 1% in reflectance		
			9.5–12.0 μm (olivine)		9.0–12.0 μm spectral range; 0.1 μm spectral resolution; absorptions greater than 1% in reflectance		
			13.1 μm (oxides)		12.0–14.0 μm spectral range; 0.02 μm spectral resolution; absorptions greater than 1% in reflectance		
			See above relating to the physical parameter "The abundance of N, P, and S relative to O."	UV-visible spectrometer	See above relating to the physical parameter "The abundance of N, P, and S relative to O."	See above relating to the physical parameter "The abundance of N, P, and S relative to O."	
		The ratio of rock/ice in the surface exposure to the 1% precision level.	Spatial variation in 350–850 nm intensity.	Impactor camera	10 m/pixel at closest approach	7.5 m/pixel at closest approach	Observe at the time leading up to impact.
		Bulk morphological properties of the ISO to 10 m resolution.	Intensity and its variation between 300–700 nm.	Spacecraft camera	25 m/pixel at closest approach	20 m/pixel at closest approach	0.3 mrad control (to keep object in field of view). Launch within six months of detection of the ISO. Camera slew of 0.43 deg/sec at closest approach.