

## 7 Week 09

### 7.1 Key concepts

- Tsiolkovsky equation
- Specific Impulse  $I_{sp}$

### 7.2 Important concepts

- Gravity assist
- Simple Moon trajectories
- Patched-conic approximation to go to the Moon, incl Moon phase trajectory
- Final velocity VS Mass ratio
- Mass of propellant needed

### 7.3 Relevant concepts

- The Earth-Moon system (but not details on Earth-Moon system)
- Details of the patched-conic approximation to go to the Moon
- Free return trajectories
- Orders of magnitude of  $I_{sp}$
- Types of propulsion systems

### 7.4 Advanced concepts

- Gravitational assist: computation of  $\delta, \beta$ , how  $\Delta v$  depends on  $\delta$
- Lunar libration
- Independent parameters to go & come back from the Moon
- Orbits around the Moon
- Errors made using the patched-conic approximation
- Allowable touchdown cones