# General Physics II at EPFL

(2018-2019 SS, Wed 17:15-19:00 and Thu 8:15-10:00, Exercise Thu 10:15-12:00)

## Mock-Examination

Date: Wednesday 6 March 2019, 17:15-19:00
Room: CE1

Subjects: Special relativity (three questions)
Problem 1:
Problem 2:
Problem 3:

**Family name, given name and the unit belong to, must be filled by the student**

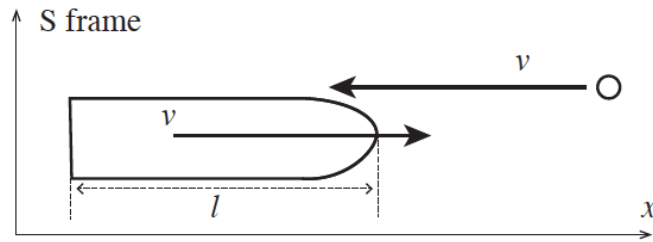| | |
|---|---|
| **Family Name** | |
| **Given Name** | |
| **Unit** | |
| ID Checked | |

# Problem 1

An observer on the earth sees that two rockets, Rocket-1 and Rocket-2, are departing from the earth in opposite directions to each other with the same speed, which is 50% of the speed of light in vacuum, i.e. $0.5c$. What is the speed of Rocket-2 seen by an observer in Rocket-1? Rocket-1 emits light toward Rocket-2, sometime after the departure. Can the light reach Rocket-2?

# Problem 2

We chose inertial S frame to be the one where the earth is at rest. In S frame, a rocket with a proper length of $l_0$ is moving in positive $x$ direction with a velocity $v$ and a meteorite in a negative $x$ direction with a velocity $v$. As shown in the figure, the rocket and meteorite are crossing each other and the meteorite travels through the full length of the rocket. Determine the time it takes for the meteorite to travel through the rocket in S, S' and S'' frame, $\Delta T$, $\Delta T'$ and $\Delta T''$, where in S' the rocket is at rest and in S'' the meteorite is at rest.

# Problem 3 (Difficult)

Two inertial frames $S_1$ and $S_2$ are moving with velocity $v_1$ and $v_2$ along the $x$-axis in the positive direction, with respect to a third inertial frame, $S$. A sand clock is placed in the $S_1$ frame at $x_1 = 0$ and kept at rest in the $S_1$ frame. The observer in the $S$ frame saw that at time $t$ all the sand dropped to the bottom. Calculate the time when the observer in the $S_2$ frame saw that all the sand dropped to the bottom, as a function of $t$, $v_1$ and $v_2$.