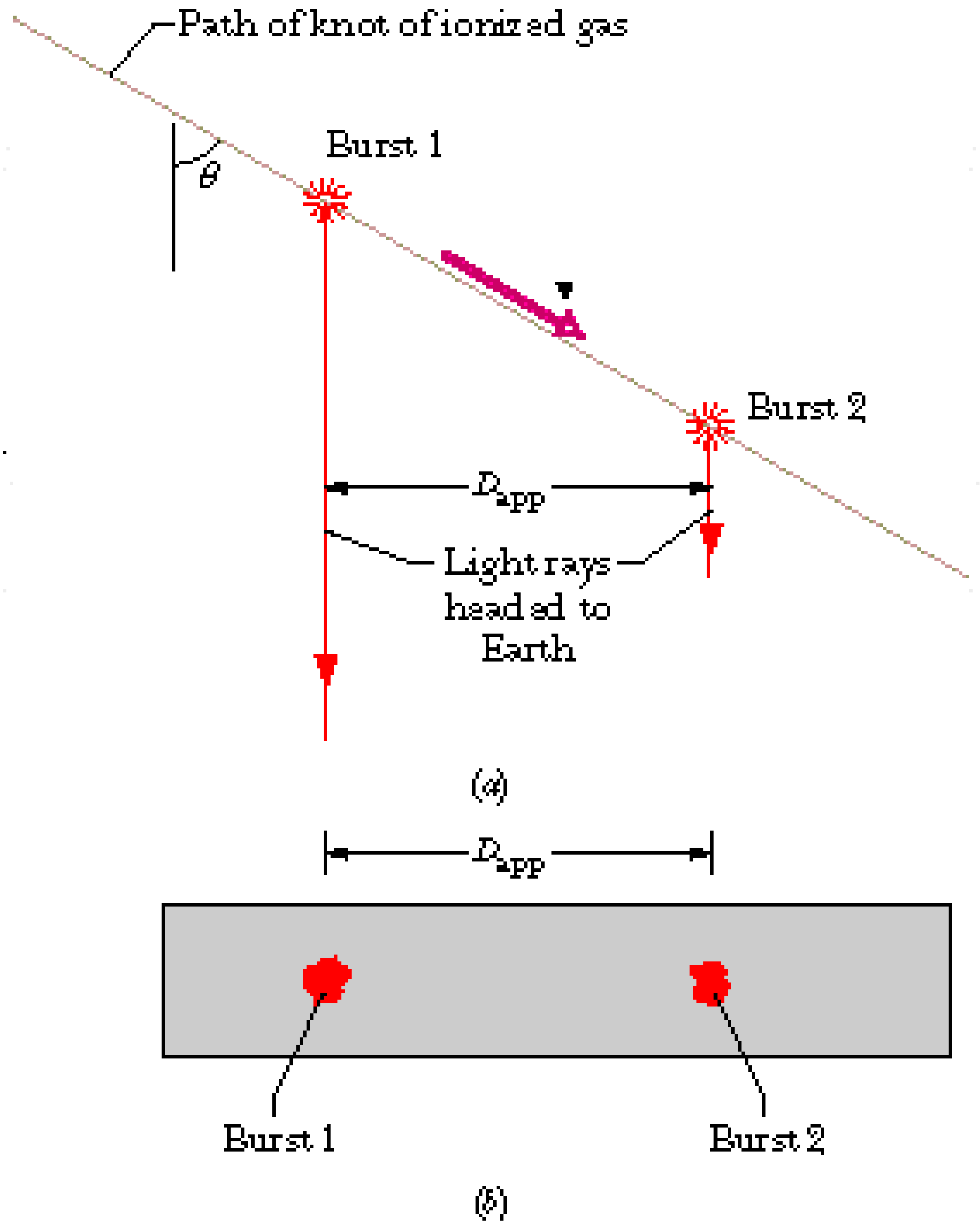
Physics 495

Homework No. 2 due Wednesday, 9 September, 2009

1. Please do problem 2.21 from Rindler's text. You might find the following diagram helpful:



2. Please do problem 4.1 from Rindler's text. Be sure and turn in the "suggested" Minkowski diagram with some light rays showing what the problem is about.

3. Please do problem 5.2 from Rindler's text. I note that Rindler uses the "wrong" definition of the sign of the invariant interval, so please use **my** definition instead.

4. Use the formula for a pure Lorentz transformation, as a 4×4 matrix, that takes measurements made by a frame $\mathcal{O}$, that measures a second frame, $\mathcal{O}'$, to be moving with velocity $\vec{\beta}$, and transforms them to measurements made by $\mathcal{O}'$. We will label such a transformation by the symbols $\Lambda(\vec{\beta})$. Use it to write down this transformation for the two cases (i), $\vec{\beta} = v\hat{x}$, and (ii) $\vec{\beta} = v\hat{y}$, i.e., to write down the matrices $\Lambda(v\hat{x})$ and $\Lambda(v\hat{y})$. Then calculate the two product matrices

$$L_{xy} \equiv \Lambda(v\hat{x})\Lambda(v\hat{y}) \ , \qquad L_{yx} \equiv \Lambda(v\hat{y})\Lambda(v\hat{x}) \ .$$

(You are encouraged to use a computer-algebra program to do these calculations, although it is not absolutely required.)

Then show, first, that the two resulting 4×4 matrices are in fact different, and, secondly, that neither one of them is a pure Lorentz transformation, that is a matrix of the general form $\Lambda(\vec{\beta})$ for any value of $\vec{\beta}$.