

# NYU Physics I—spacetime diagrams

- 1 Draw a spacetime diagram for your own rest-frame. On the spacetime diagram, show your own world-line.
- 2 Imagine there is a galaxy flying away from you with a velocity  $v = 0.5c$ . When the galaxy is moving away, it sends back to you a light signal every  $T' = 3.3\text{ ns}$  (as recorded in the galaxy's rest frame). Draw the world-line of this galaxy on your spacetime diagram and mark the events corresponding to the departures of the signals from the galaxy. Draw at least five such events.
- 3 Draw all the world-lines for all the the signals. Mark the events of the signals reaching you.
- 4 Calculate the time intervals between the arrival events (arrivals of the signals from the galaxy) according to you (that is, in your frame). Give your answer in terms of  $T'$ ,  $\beta$ , and  $\gamma$ . *Hint:* It should be longer than what is suggested by the simple time-dilation formula.
- 5 Why do the time intervals in the previous problem *not* agree with the time-dilation formula? What, on the spacetime diagram, *does* agree with the time-dilation formula?