

4<sup>th</sup> year  
3. series  
deadline  
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**FX** [f:ks]

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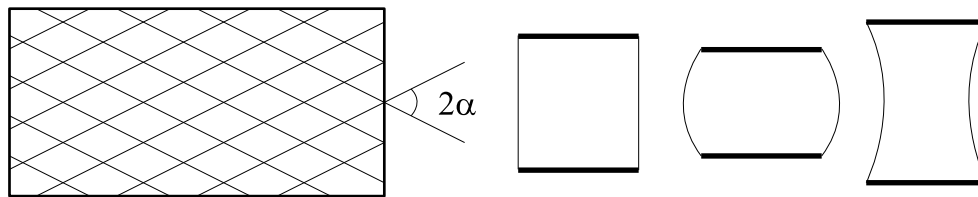
### FX7 Moon

How many times brighter is the full moon than in the first quarter?

*Assume that the Moon is a Lambertian diffuser.*

### FX8 Russian barrel

Fajo was looking for a barrel to store apples for fermentation. He found a very peculiar barrel on the market. It was cylinder-shaped, its bases were made of rigid steel. However, the rest was made of flexible rubber sheet, with inextensible but flexible steel strings woven into it (see the picture). Fajo is now wondering what happens when we increase the pressure inside the barrel. Which of the three depicted shapes will the barrel assume, depending on the value of  $\alpha$ ?



### FX9 Enterprise

Marcel spends all his vacation playing computer games and watching TV series. Recently he saw so many episodes of Star Trek that the following night he dreamt of being on the starship Enterprise, floating in a part of the universe with stars evenly distributed in the sky. That is, the number of stars in a given solid angle,  $dN/d\Omega = \rho$ , was approximately constant throughout the sky.

- (a) What is the observed distribution of stars, if the spaceship is moving with velocity  $v$ ?

Now assume that instead of stars the sky is a homogeneous monochromatic source of radiation with frequency  $f$  and total power  $P$ .

- (b) What will the observed frequency of the radiation be when the spaceship is moving? (Dependent on the direction of observation, of course.)  
(c) What can we deduce from (a) and (b) about the change of the radiation power density  $\Pi = dP/d\Omega$  of the sky?