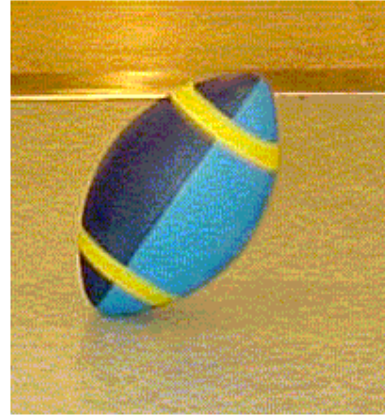
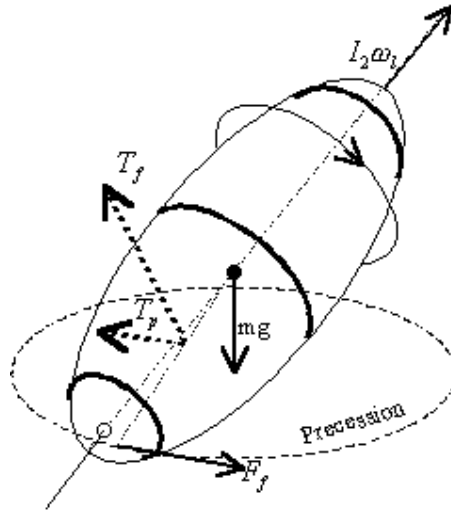


Rugbyball

Aim: To show how a rotating rugbyball lifts itself
Subjects: 1Q60 (Rotational Stability)
Diagram:



Equipment: • Rugbyball

Rugbyball

Presentation: The rugbyball lies on the floor. By hand it is given a fast spin around its short axis (see Figure1).

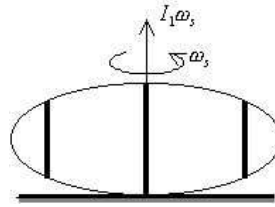


Figure 1

When the ball has made some turns it lifts itself, finally standing on its nose (tail) and rotating around its long axis.

- Explanation:
- When the ball turns around its short axis (ω_s) it will tilt its long axis a little due to unbalanced mass distribution. Then spinning around its long axis (ω_l) will start (see Figure2) and at the same time, the long axis starts a precession ($I_2\omega_l$ moves into the direction of T_p).

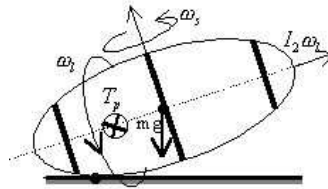


Figure 2

- The point of contact slips on the floor (see Diagram). The friction force (F_f) on the ball is pointing in the same direction as its direction of precession. The torque (T_f) of this friction force is pointing upward (see Diagram), almost perpendicular to $I_2\omega_l$. So the friction force gives a torque that erects the ball ($I_2\omega_l$ moves into the direction of T_f).
- See also the demonstrations "Precession 3a" and "Precession 3b" in this database where it is shown how a precessing object reacts to an applied torque.

- Remarks:
- Friction between ball and floor must be high enough to make this demonstration successful.
 - This demonstration can also be done with a hardboiled egg. Doing it on my kitchentable, the angular speed of the egg must be quite high to reach the lifting effect.

- Sources:
- [Borghouts, A.N., Inleiding in de Mechanica](#), pag. 230-231
 - [Friedrich, Artur, Handbuch der experimentellen Schulphysik, part 2, Mechanik der festen Körper](#), pag. 233-235
 - [Roest, R., Inleiding Mechanica](#), pag. 230-231