CONCORSO PUBBLICO, PER ESAMI, A N. 1 POSTO DI CATEGORIA D POSIZIONE ECONOMICA D1, AREA TECNICA, TECNICO-SCIENTIFICA ED ELABORAZIONE DATI, PER LE ESIGENZE DEL DIPARTIMENTO DI SCIENZE DELLA TERRA, DELL'AMBIENTE E DELLE RISORSE (DISTAR) DELL'UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II (COD. RIF. 2002) INDETTO CON DECRETO DEL DIRETTORE GENERALE N. 441 DEL 30.06.2020 E PUBBLICATO SULLA G.U. IV SERIE SPECIALE – CONCORSI ED ESAMI – N. 53 DEL 10.07.2020

GRUPPO DOMANDE ESTRATTE PROVA ORALE DEL 22/09/2020

- ✓ Il candidato illustri vantaggi e limiti della strumentazione correntemente utilizzata per misure magnetometriche in contesti urbani.
- ✓ Il candidato illustri la procedura per la preparazione, esecuzione e gestione di una prova di taglio diretto.
- ✓ Il candidato illustri alcune delle tecniche geofisiche utilizzate per misure in sito delle caratteristiche elastiche ed anelastiche dei terreni.
- ✓ Il candidato illustri come è possibile gestire, rappresentare e analizzare dati di sismica a rifrazione in ambiente Excel.
- ✓ Il candidato descriva le caratteristiche del magnetometro a protoni con effetto Overhauser in assetto gradiometrico e i principali vantaggi del suo utilizzo per rilievi in contesti urbanizzati.
- ✓ Il candidato illustri la procedura per la preparazione, esecuzione e gestione di una prova granulometrica su terre con frazione coesiva.
- ✓ Il candidato descriva le principali funzionalità di software avanzati per l'acquisizione e inversione di dati di tomografia elettrica.
- ✓ Il candidato illustri come è possibile gestire, rappresentare e analizzare dati di una prova penetrometrica dinamica in ambiente Excel.

PER ORDINE DEL PRESIDENTE

IL SEGRETARIO DELLA COMMISSIONE

f.to dott. Pasquale PIROLLI

3.3 Instrumentation

The *proton precession magnetometer* is a relatively simple instrument that measures the total intensity $|\mathbf{B}|$ of the magnetic field. Its operation is based on the fact that a proton H^+ in an external magnetic field undergoes a precession about its spin axis, like a spinning top (see Figure 3.9a).

A proton may be regarded as a spinning magnetized sphere (Figure 3.9b) with an intrinsic magnetic moment m_P and an intrinsic spin angular momentum I_P, both of which are atomic constants. The gyromagnetic ratio is defined as their ratio $\gamma_P = m_P/I_P = 0.2675222$ [1/s nT]. Suppose the proton is placed in a magnetic field $\mathbf{H} = \mathbf{B}/\mu_0$. The effect of the magnetic field is to exert a torque on the spinning proton which tends to align the intrinsic magnetic moment into the direction of the external field. The proton starts to precess about its spin axis, just as a spinning top does in the presence of the gravitational torque $\tau = mgx$. The angular frequency of the proton precession is $\omega_P = \gamma_P|\mathbf{H}|$, which is known as the *Larmor frequency*.

The proton precession magnetometer measures the precession frequency ω_P, from which the total intensity of the magnetic field is easily found using the formula $|\mathbf{H}| = \omega_P/\gamma_P$. The operating principle may be briefly summarized as follows (e.g. Campbell, 2003). The intrinsic magnetic moment of an ensemble of protons is first brought into rough alignment with a strong external field $\mathbf{H}_0$ of $\sim 10^7$ nT. The external field is abruptly shut off. The proton moments then start to precess about the direction of the much weaker, ambient magnetic field, $\mathbf{H}$. The precession is observed as an oscillating voltage (of order millivolts) in a pickup coil wrapped around the ensemble of protons. The oscillation frequency is ω_P, the Larmor frequency. The same coil may be used for the excitation and the pickup and typically consists of ~ 500 turns wound around a cylinder containing a proton-rich liquid

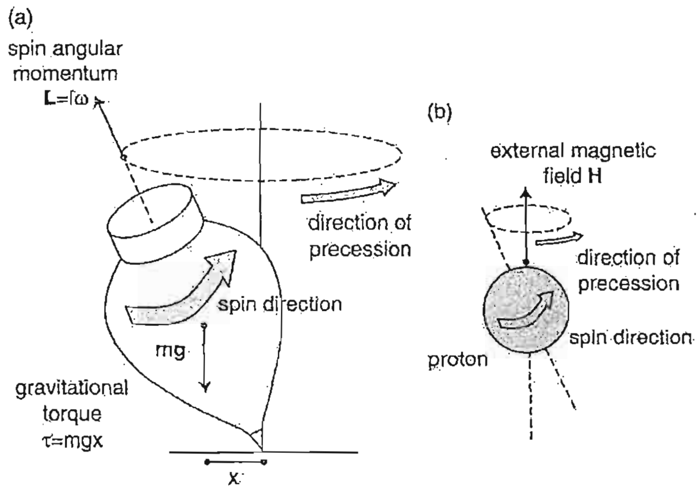

Figure 3.9 (a) Precession of a top of mass m and moment of inertia I spinning with angular frequency ω in a gravitational field $\mathbf{g}$; (b) precession of a spinning proton in a magnetic field $\mathbf{H}$.

8.5 Terrain conductivity meters

A simple electromagnetic geophysical reconnaissance tool is the terrain conductivity meter (McNeill, 1980). This frequency-domain instrument operates as a purely inductive system in which transmitter (TX) and receiver (RX) loops do not make electrical contact with the ground. The two loops are magnetically flux-linked to each other and to the conductive ground as shown schematically by the circuits in Figure 8.7. Two popular terrain conductivity meters are the Geonics EM31 and EM34 instruments (www.geonics.com) shown in Figure 8.9. The EM31 operates at 9.8 kHz and has TX–RX intercoil spacing of 3.66 m. The EM34 has three different intercoil spacings: 10, 20, and 40 m; these operate at, respectively, 6.4, 1.6, and 0.4 kHz. The EM34 can be used with vertical coplanar coils (horizontal dipole, or HD mode), or horizonal coplanar coils (vertical dipole, or VD mode) in which case the coils are laid flat on the ground.

The operating principle of the terrain conductivity meter is based on classical EM induction theory. A time-harmonic current of the form $I(t) = I\sin(\omega t)$ is passed through the TX loop. The primary magnetic field due to the current flowing in the transmitter loop is in-phase with the current and consequently has the form

$$\mathbf{B}^P(\rho, t) = \mathbf{B}_0(\rho)\sin(\omega t), \tag{8.17}$$

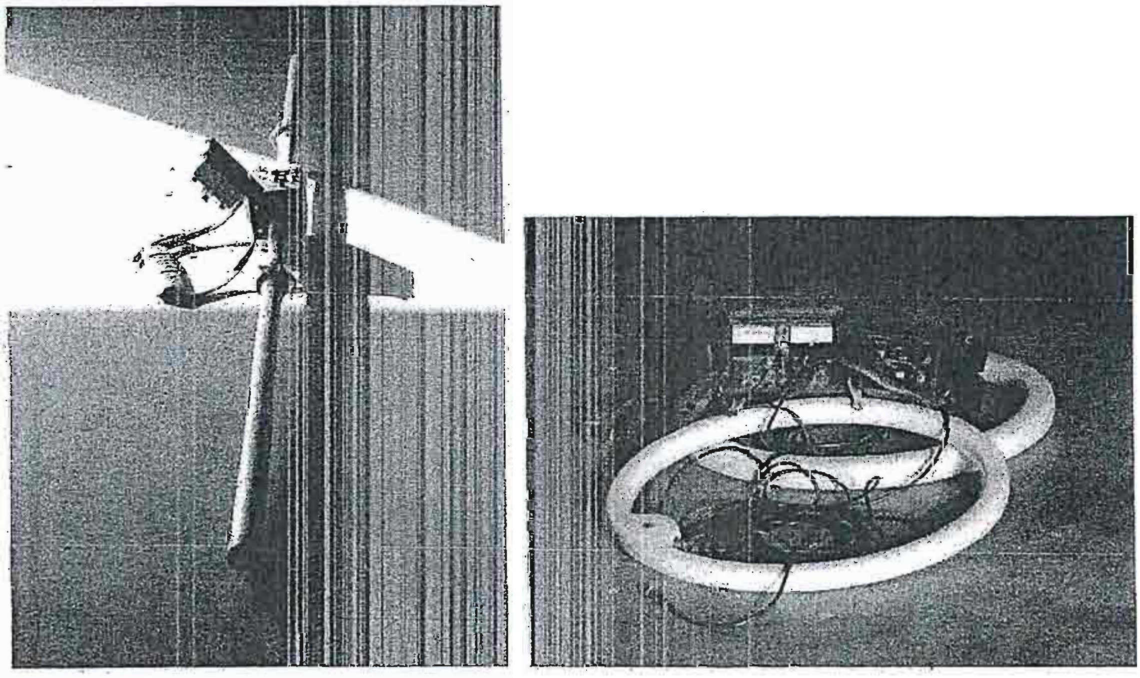

Figure 8.9 Terrain conductivity meters: (left) Geonics EM31; (right) Geonics EM34.