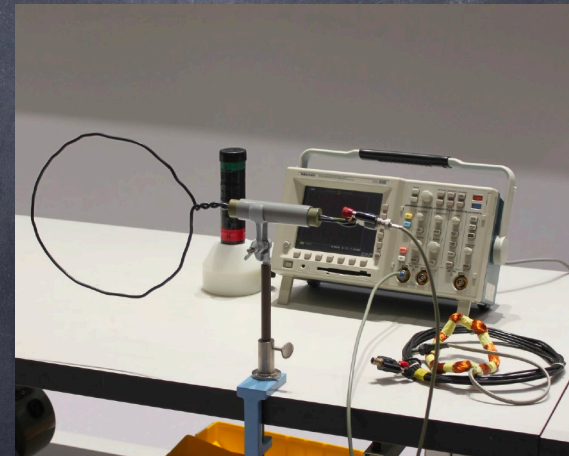
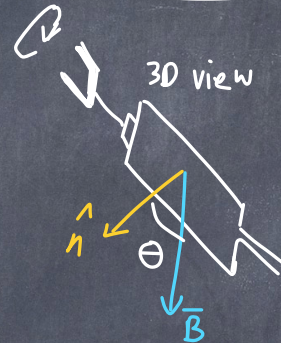
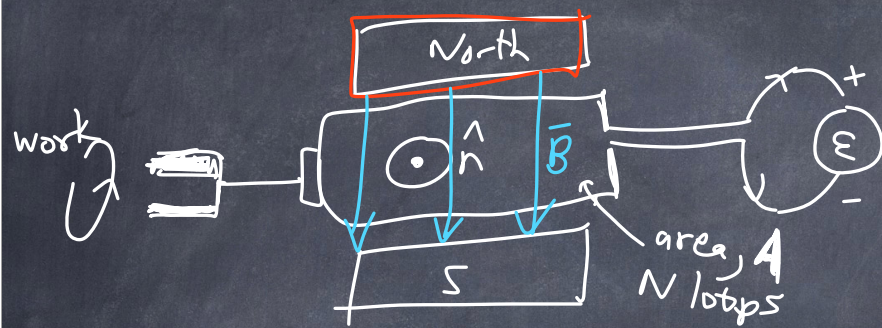


# PHY 117 HS2024

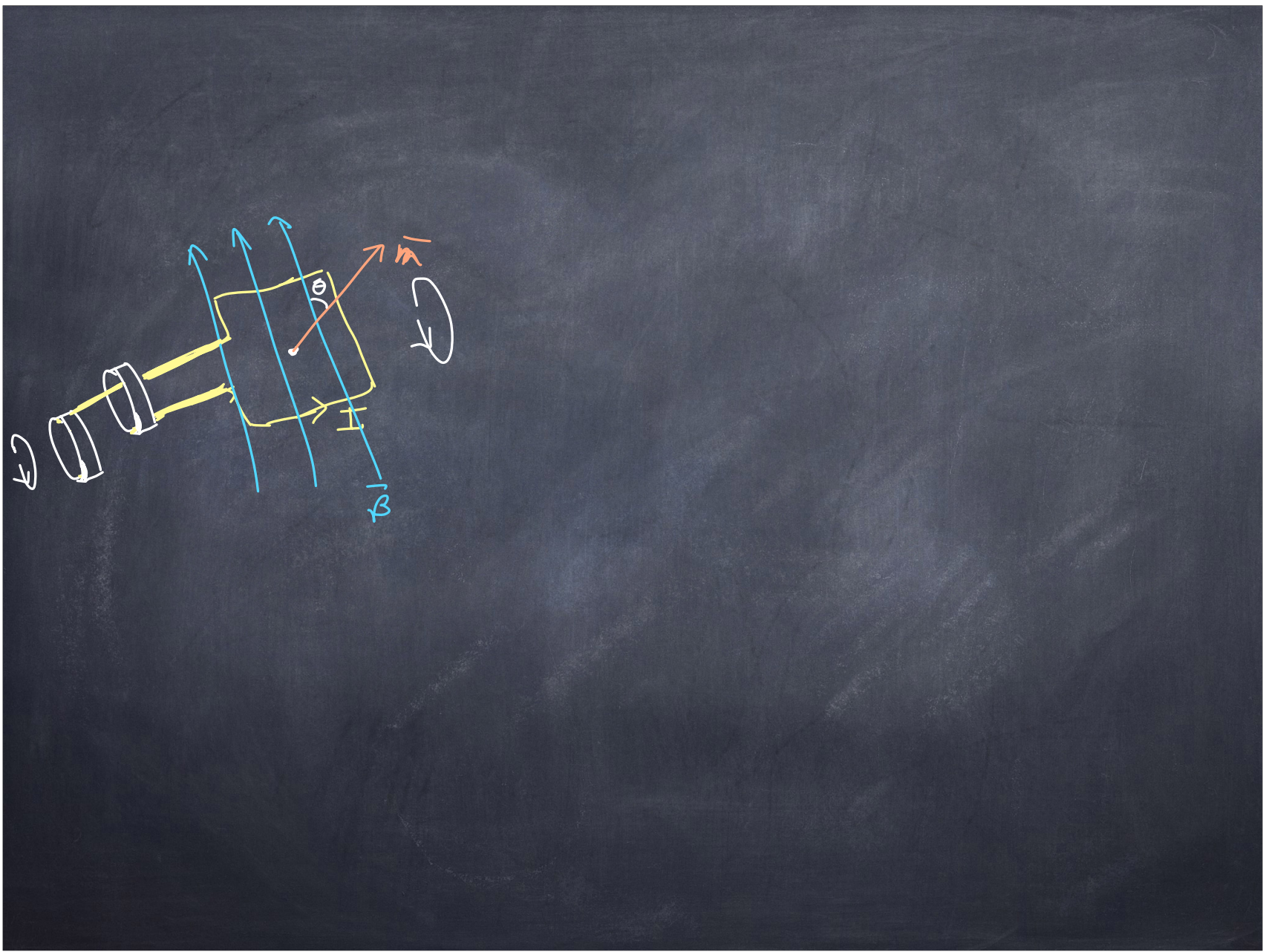
Week 11, Lecture 1  
Nov. 26th, 2024  
Prof. Ben Kilminster

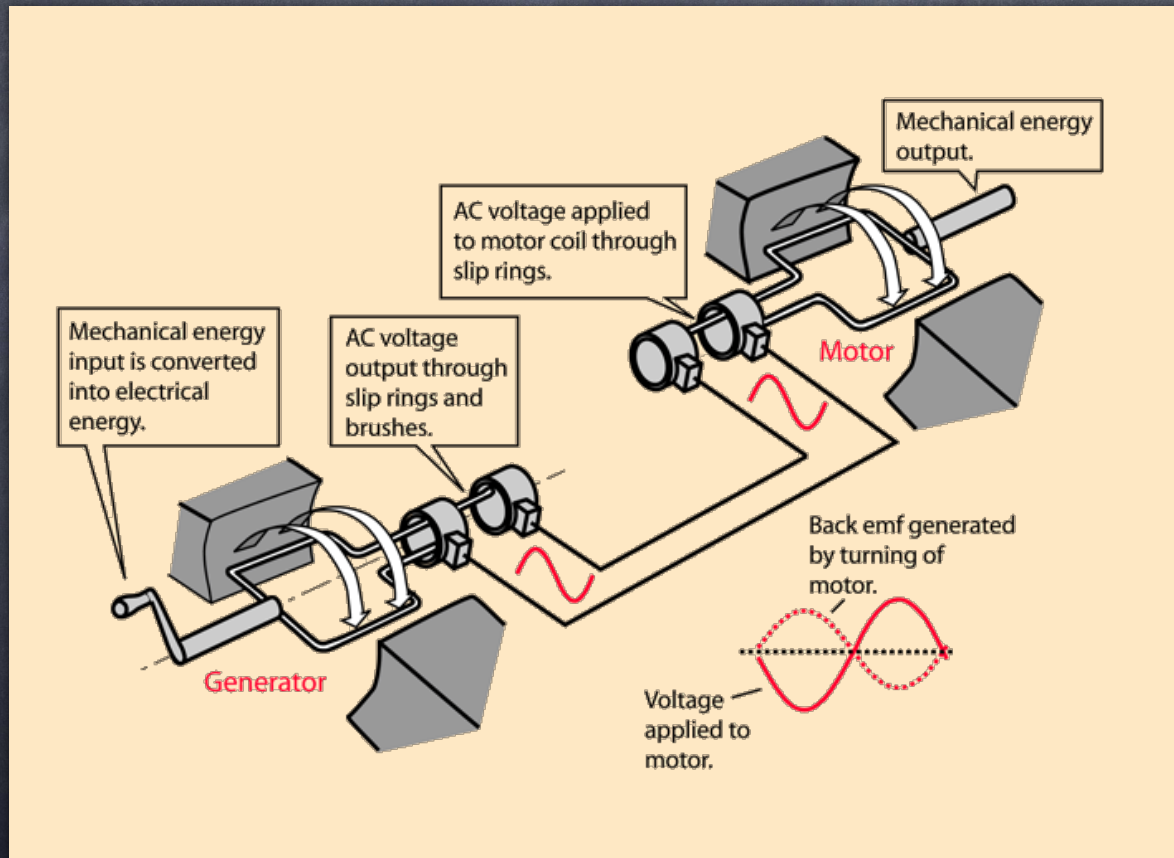


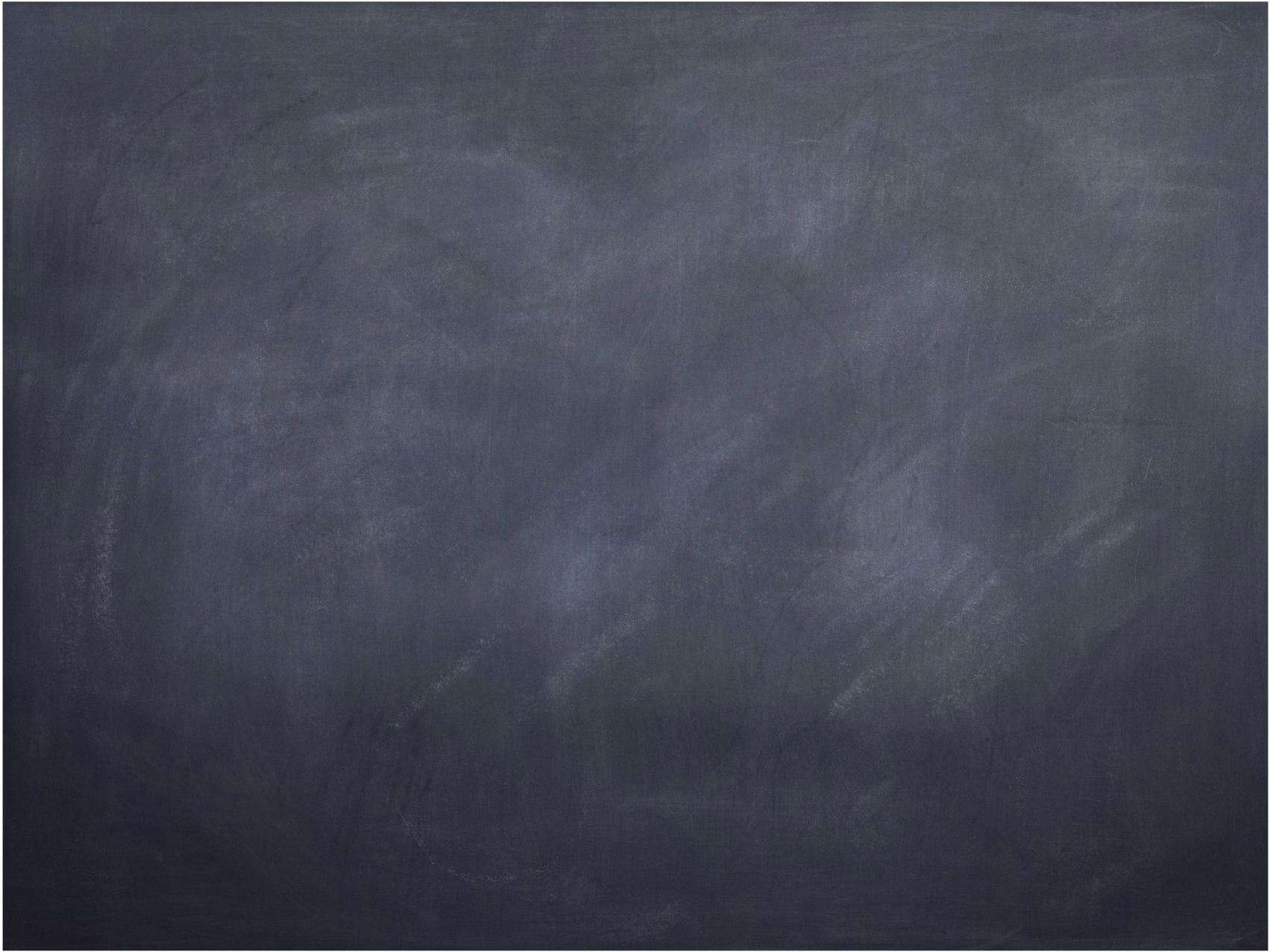
Most electrical energy used today produced by AC (alternating current) electric generators.

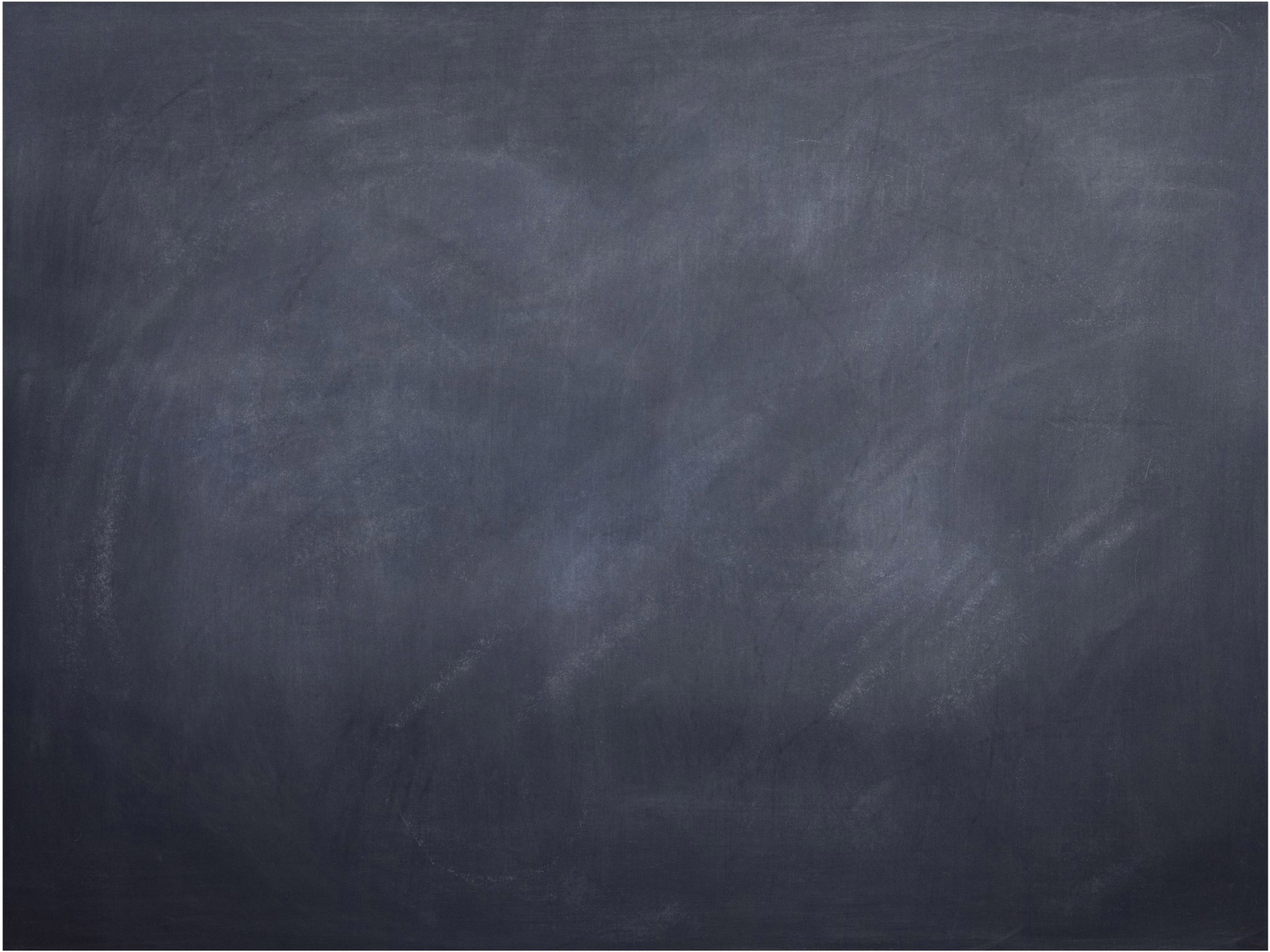


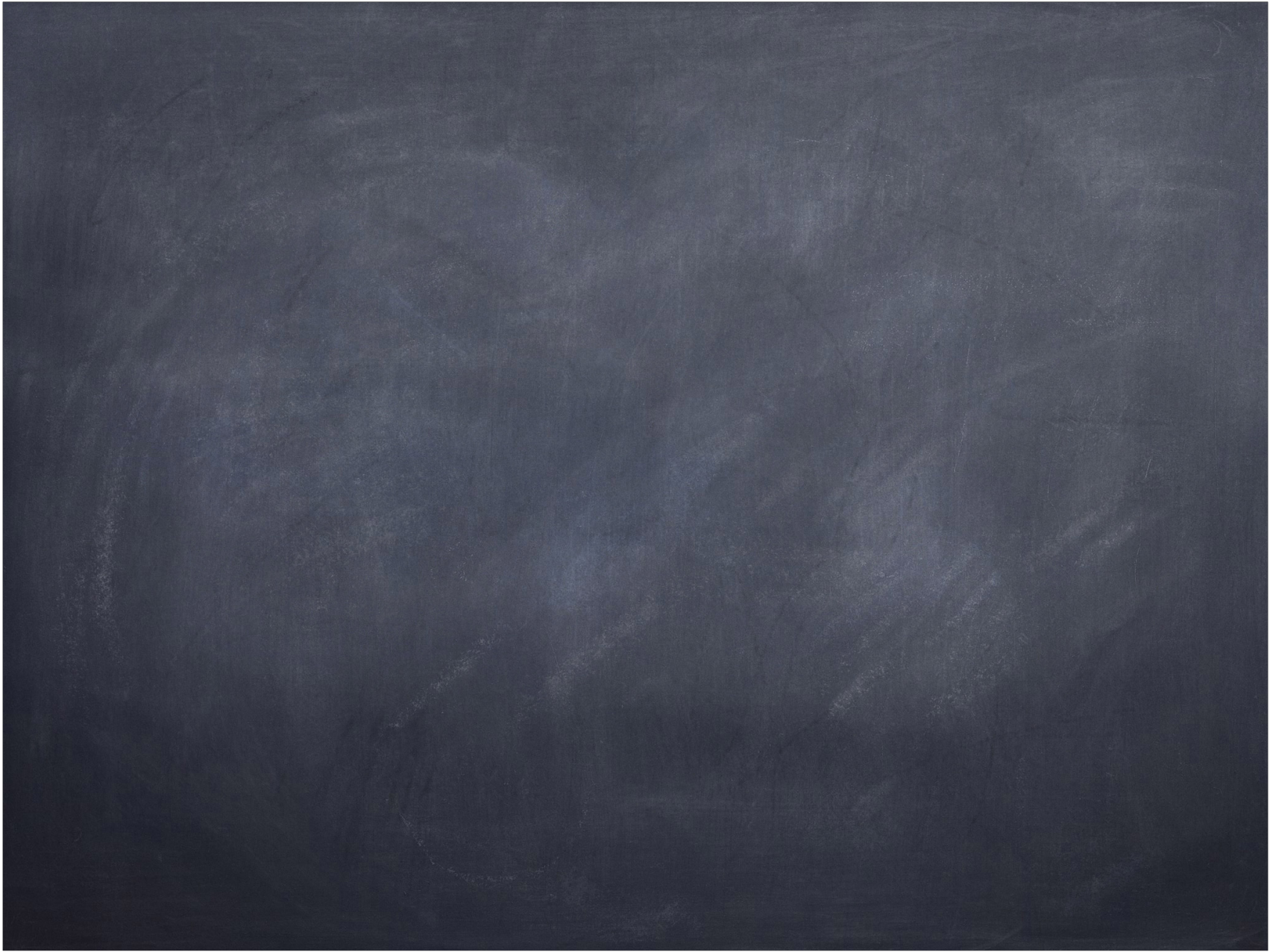
when  
 $\vec{B} \perp \hat{n}$ ,  $\theta = 90^\circ$   
 $\cos \theta = 0$   
(no flux)







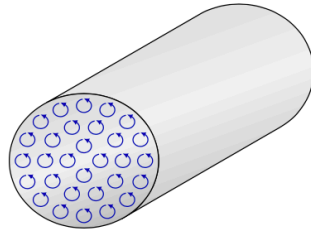




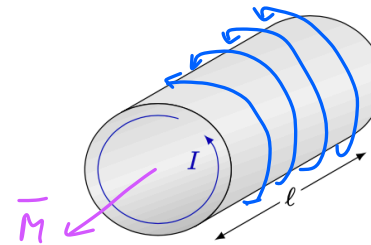
In a material, if magnetic moments align,

### 11.3. MAGNETIZATION

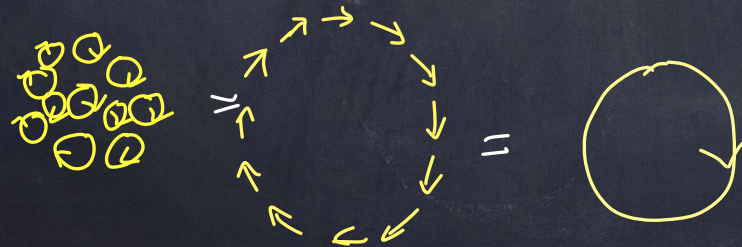
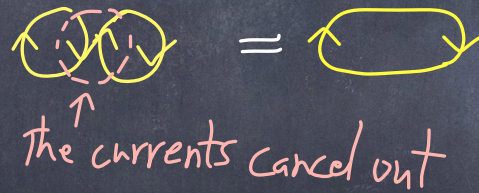
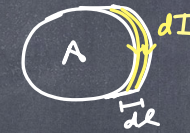
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(a) Each atom has its own small current loops, and their own magnetic moment.

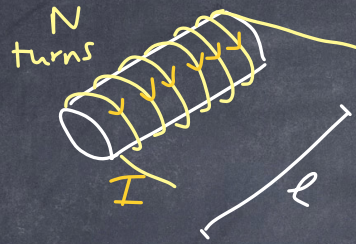


(b) One can think of the microscopic currents adding up to one big one.





Magnetic moment of hollow solenoid:

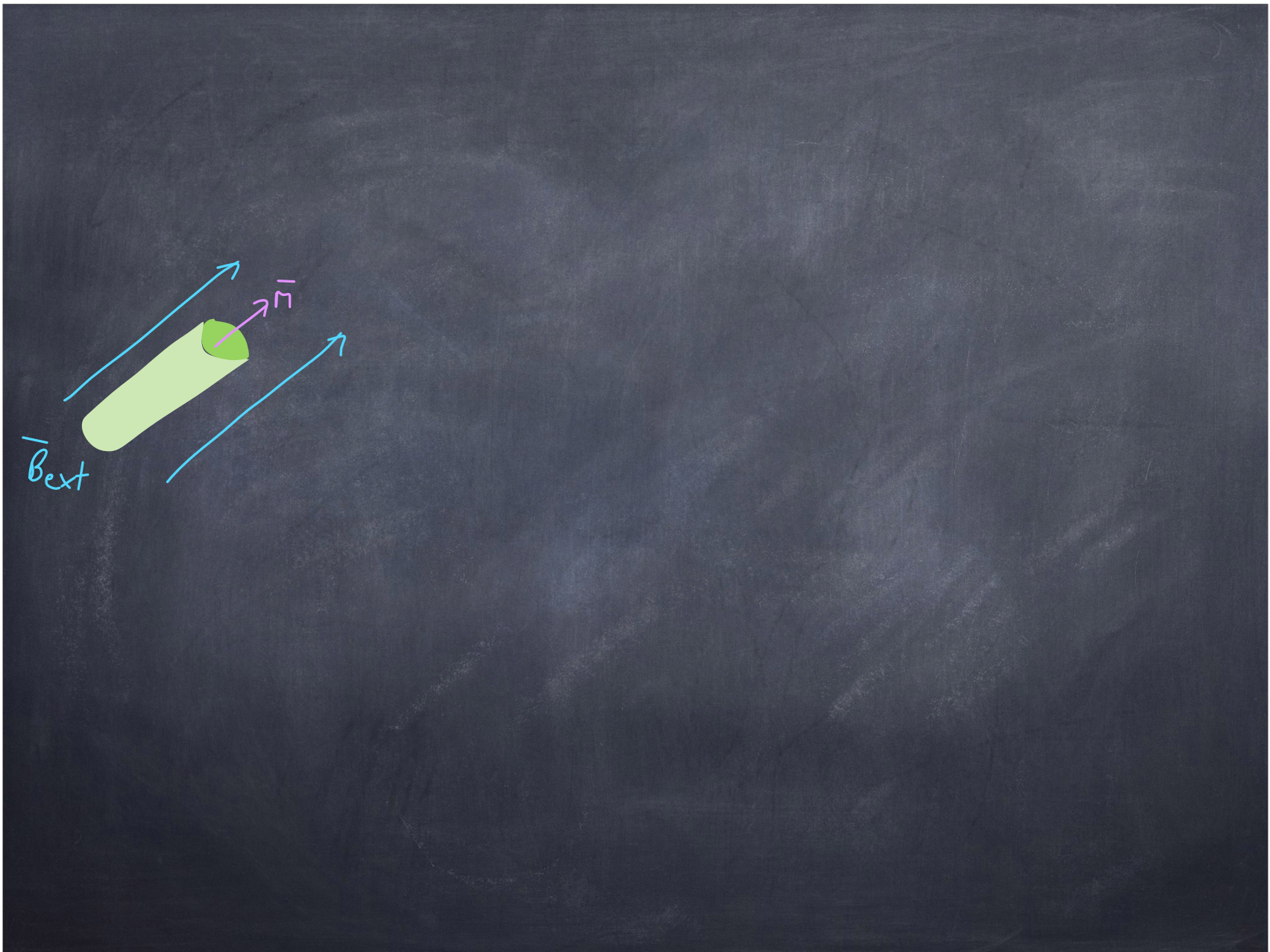


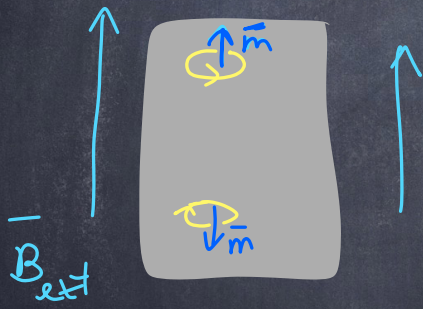
$$M = \frac{NI}{l}$$

$\chi_m$ : magnetic susceptibility

$$\chi_m = \frac{M}{M_0} - 1$$

<u>material</u>	<u><math>\chi_m</math></u>
Al	$2.3 \times 10^{-5}$
Gold	$-3.6 \times 10^{-5}$
BismutL	$-1.66 \times 10^{-5}$
nickel	600
iron pure	200,000
Copper	$-9.6 \times 10^{-6}$
water	$-9 \times 10^{-6}$
graphite	$(1 \times 10^{-5} \text{ } 1 \times 10^{-3})$ (depends on orientation)





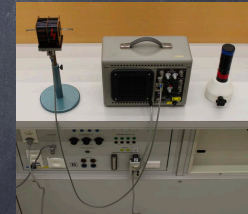
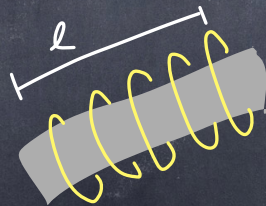


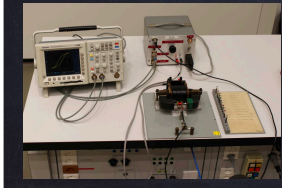
Ferromagnetism - materials with large, positive values of  $\chi_m$ .  
(iron, cobalt, nickel)

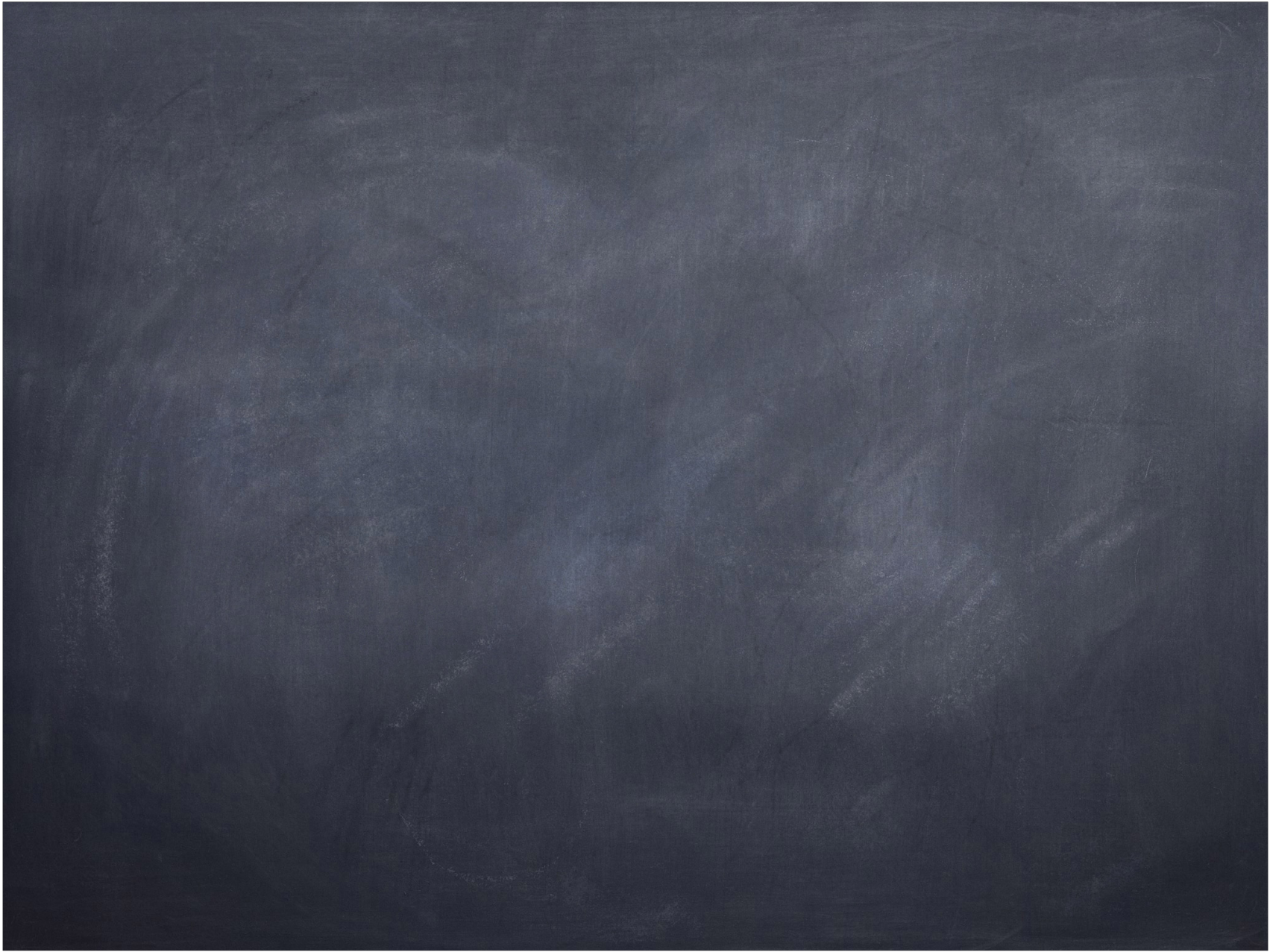
$B_{ext}$   $\Rightarrow$



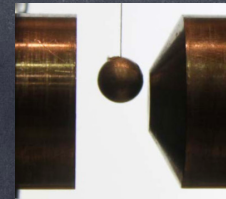
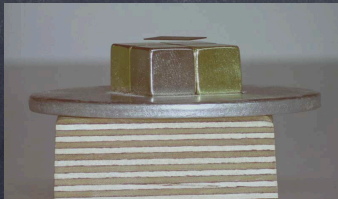
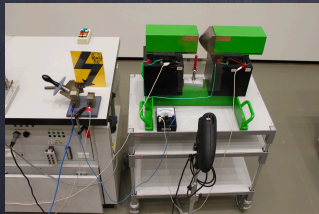
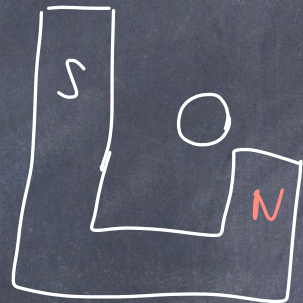
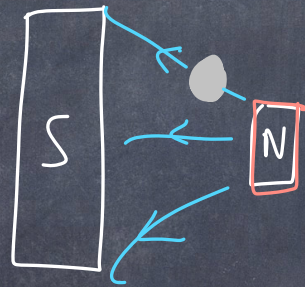
Atoms exert strong force on neighbors, causing alignment in groups called domains.

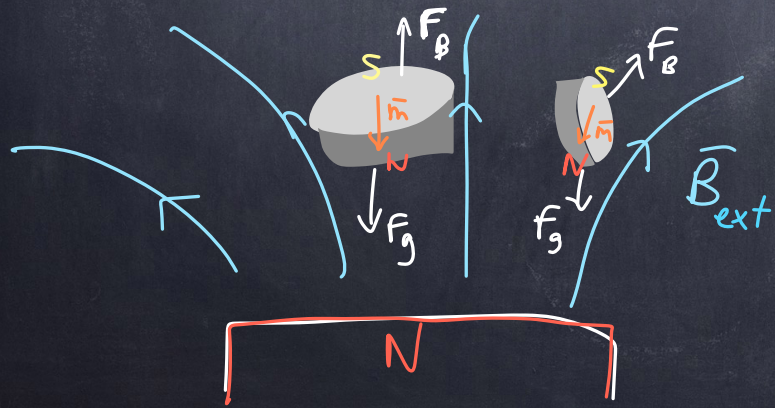
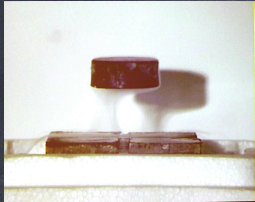


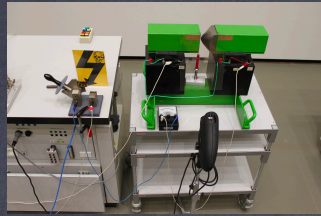




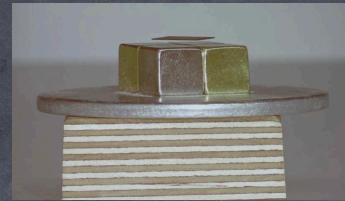




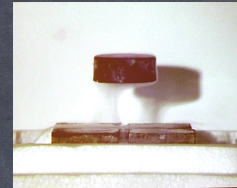




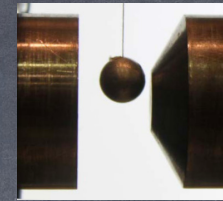
ED28



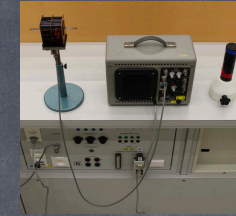
ED29



ED30



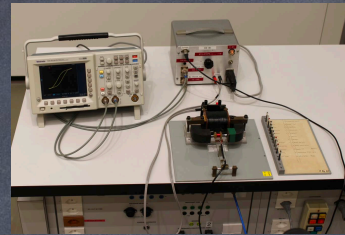
ED32



ED34



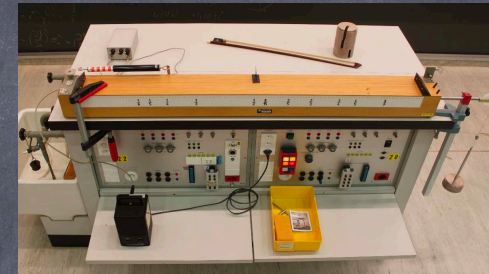
ED35



ED40



ED41



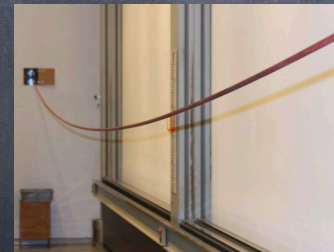
W14



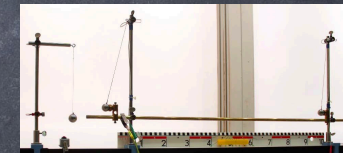
W18



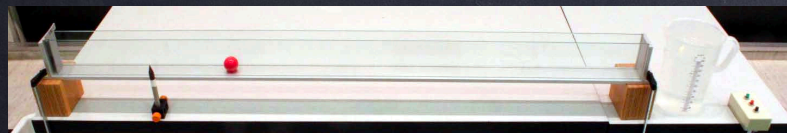
W24



W28



W32



W31



W33