Vergleich von Elektrostatik und Magnetostatik

	Elektrostatik	Magnetostatik
Quellen	Ladungsdichte ρ	Stromdichte $\boldsymbol{j}$
statisch	$\frac{\partial \rho}{\partial t} = 0$	div$\boldsymbol{j} = 0$
Felddefinition	$\boldsymbol{F}_{\text{el.}} = q\boldsymbol{E}$	$\boldsymbol{F}_{\text{mag.}} = q\dot{\boldsymbol{r}} \times \boldsymbol{B}$
homogene FG	rot$\boldsymbol{E} = 0$	div$\boldsymbol{B} = 0$
Potenzial	$\boldsymbol{E} =$ gradΦ – Gradientenfeld	$\boldsymbol{B} =$ rot$\boldsymbol{A}$ – Wirbelfeld
Eichfreiheit	$\Phi \to \Phi +$ const.	$\boldsymbol{A} \to \boldsymbol{A} +$ gradΛ
Standardeichung	$\Phi = 0$ für $r \to \infty$	div$\boldsymbol{A} = 0$ (Coulomb-Eichung)
integrale Form	$\boldsymbol{E}$ wirbelfrei	$\boldsymbol{B}$ quellenfrei
	$\oint_C \boldsymbol{E} d\boldsymbol{r} = 0$	$\oint_S \boldsymbol{B} d\boldsymbol{a} = 0$
inhomogene FG	div$\boldsymbol{E} = \rho/\varepsilon_0$	rot$\boldsymbol{B} = \mu_0 \boldsymbol{j}$
Poisson-Gleichung	$\Delta\Phi = -\rho/\varepsilon_0$	$\Delta\boldsymbol{A} = -\mu_0\boldsymbol{j}$ (div$\boldsymbol{A} = 0$)
Potenzial	$\Phi(\boldsymbol{r}) = \frac{1}{4\pi\varepsilon_0} \int d^3r' \frac{\rho(\boldsymbol{r}')}{\lvert\boldsymbol{r} - \boldsymbol{r}'\rvert}$	$\boldsymbol{A}(\boldsymbol{r}) = \frac{\mu_0}{4\pi} \int d^3r' \frac{\boldsymbol{j}(\boldsymbol{r}')}{\lvert\boldsymbol{r} - \boldsymbol{r}'\rvert}$
Feld	$\boldsymbol{E}(\boldsymbol{r}) = \frac{1}{4\pi\varepsilon_0} \int d^3r' \rho(\boldsymbol{r}') \frac{\boldsymbol{r} - \boldsymbol{r}'}{\lvert\boldsymbol{r} - \boldsymbol{r}'\rvert^3}$	$\boldsymbol{B}(\boldsymbol{r}) = \frac{\mu_0}{4\pi} \int d^3r' \boldsymbol{j}(\boldsymbol{r}') \times \frac{\boldsymbol{r} - \boldsymbol{r}'}{\lvert\boldsymbol{r} - \boldsymbol{r}'\rvert^3}$
integrale Form	Gaußsches Gesetz	Ampèresches Durchflutungsgesetz
	$\oint_{S(V)} \boldsymbol{E} d\boldsymbol{a} = Q_V/\varepsilon_0$	$\oint_{C(S)} \boldsymbol{B} d\boldsymbol{r} = \mu_0 I_S$
	Feld einer Punktladung q:	Feld eines linearen Stomfadens I:
	$\boldsymbol{E} = \frac{q}{4\pi\varepsilon_0} \frac{\boldsymbol{r}}{r^3}$	$\boldsymbol{B} = \frac{\mu_0 I}{2\pi} \frac{\boldsymbol{e}_\varphi}{\rho}$ (Biot-Savart-Gesetz)
Kraftgesetz	Coulomb:	Ampère:
	$\boldsymbol{F}_{12} = \frac{q_1 q_2}{4\pi\varepsilon_0} \frac{\boldsymbol{r}_1 - \boldsymbol{r}_2}{\lvert\boldsymbol{r}_1 - \boldsymbol{r}_2\rvert^3}$	$\boldsymbol{F}_{12} = -\frac{\mu_0 I_1 I_2}{4\pi} \oint \oint (d\boldsymbol{r}_1 d\boldsymbol{r}_2) \frac{\boldsymbol{r}_1 - \boldsymbol{r}_2}{\lvert\boldsymbol{r}_1 - \boldsymbol{r}_2\rvert^3}$
Dipolmoment	$\boldsymbol{p} = \int d^3r\, \boldsymbol{r} \rho(\boldsymbol{r})$	$\boldsymbol{m} = \frac{1}{2} \int d^3r\, \boldsymbol{r} \times \boldsymbol{j}(\boldsymbol{r})$
Dipolfeld	$\boldsymbol{E} = \frac{1}{4\pi\varepsilon_0} \frac{3\boldsymbol{r}(\boldsymbol{r}\boldsymbol{p}) - r^2\boldsymbol{p}}{r^5}$	$\boldsymbol{B} = \frac{\mu_0}{4\pi} \frac{3\boldsymbol{r}(\boldsymbol{r}\boldsymbol{m}) - r^2\boldsymbol{m}}{r^5}$
Feldenergiedichte	$w = \frac{\varepsilon_0}{2} \boldsymbol{E}^2$	$w = \frac{1}{2\mu_0} \boldsymbol{B}^2$