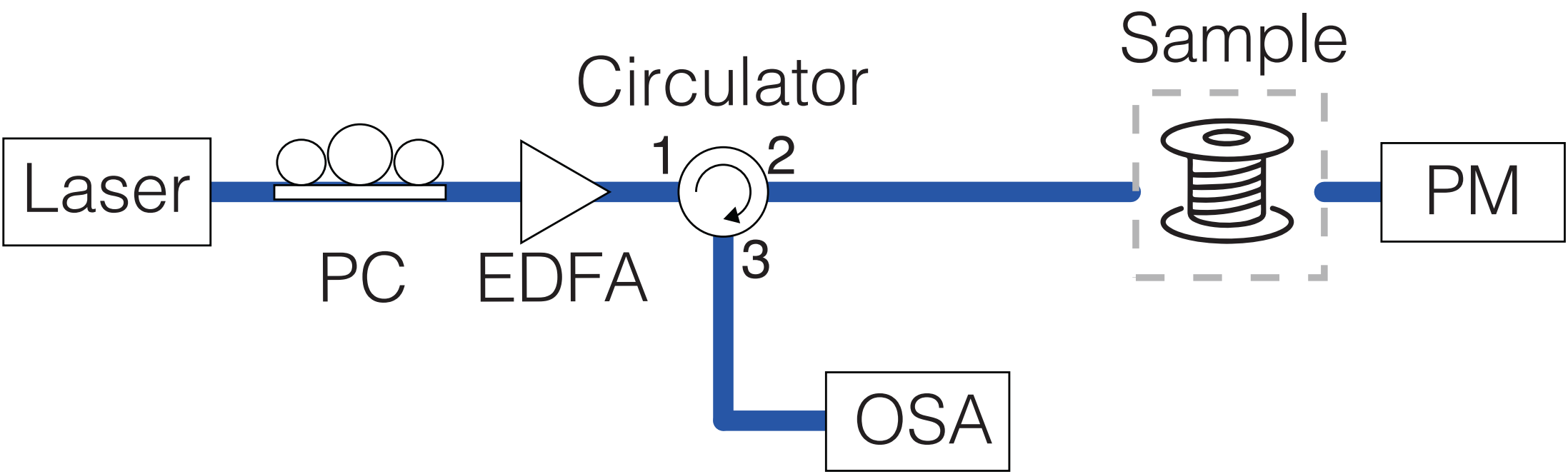
Brillouin scattering

Backward BS may grow strong in a standard optical fiber

9

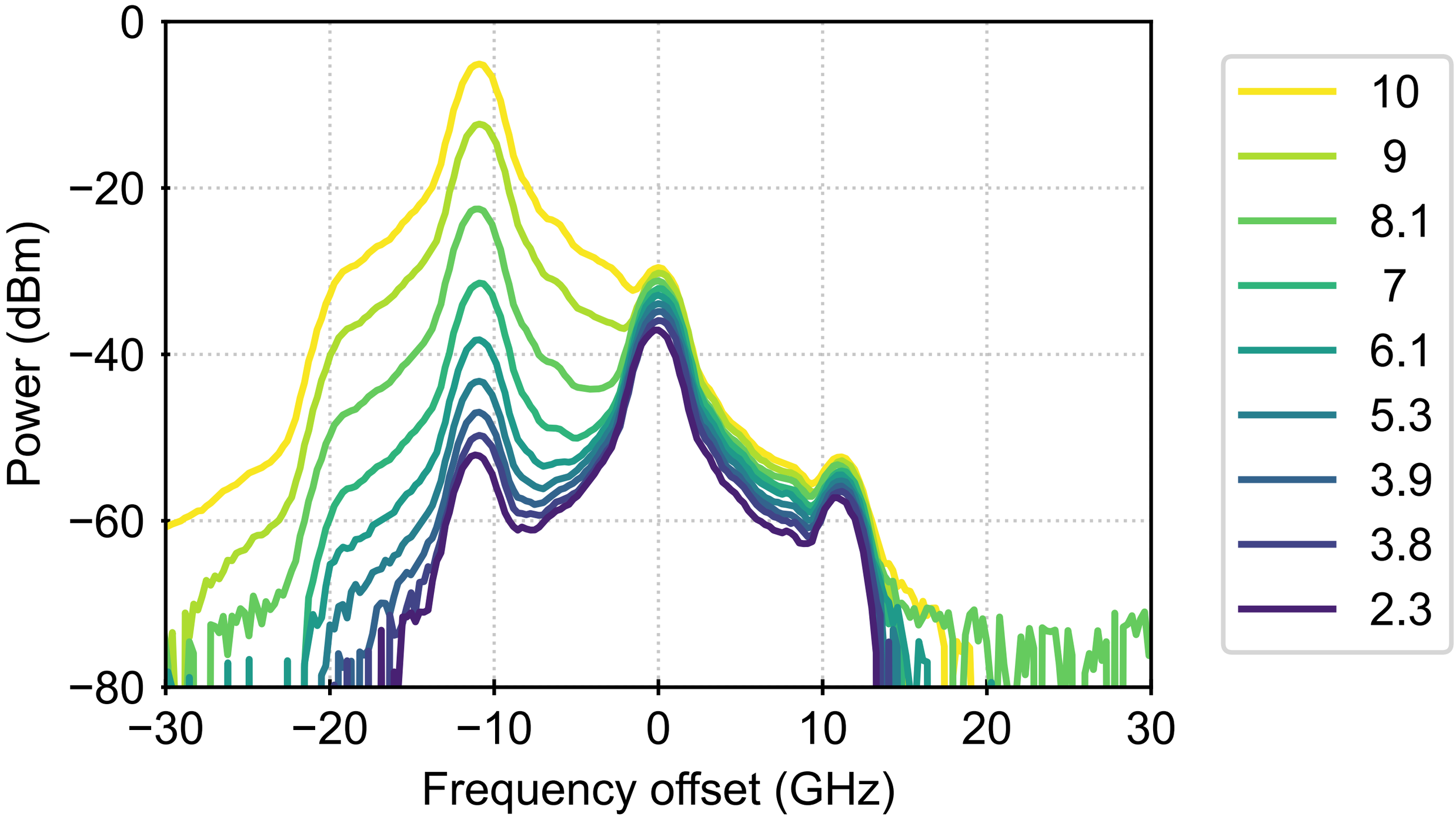
Wombat 2022, Erlangen, June 14th 2022. Gustavo Wiederhecker.


Sample
Circulator
Laser
1
2
PM
PC
EDFA
3
OSA

22 km SMF-28

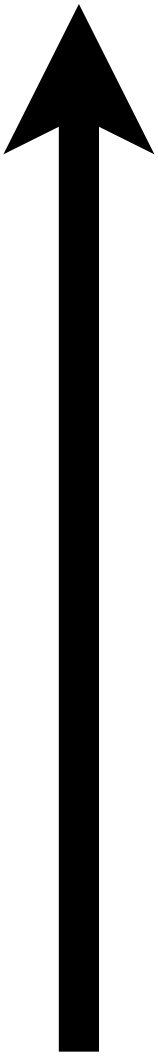
fiber spool

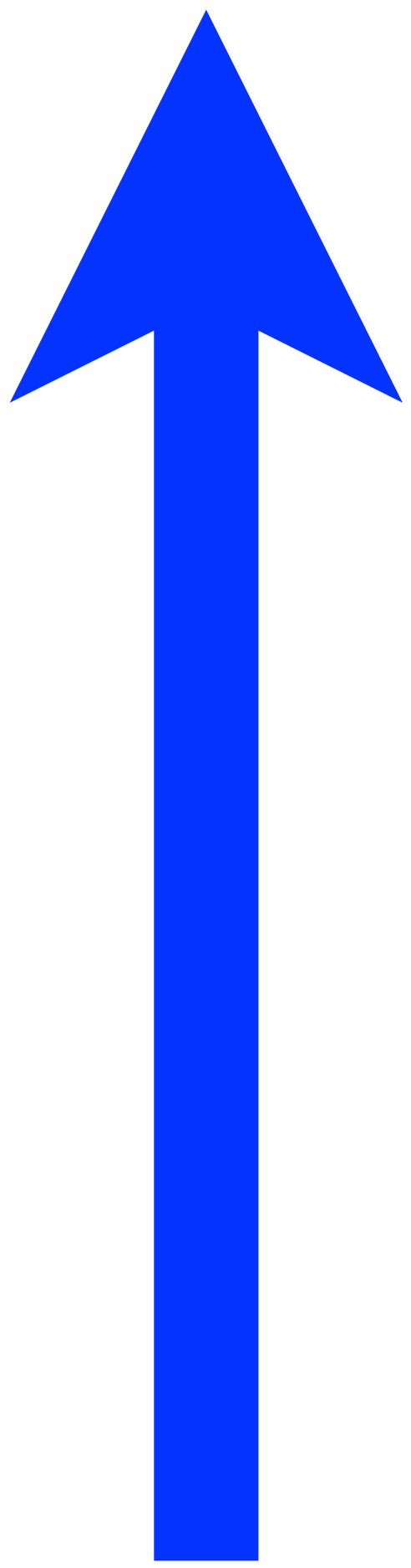
RBW: 2.5 GHz

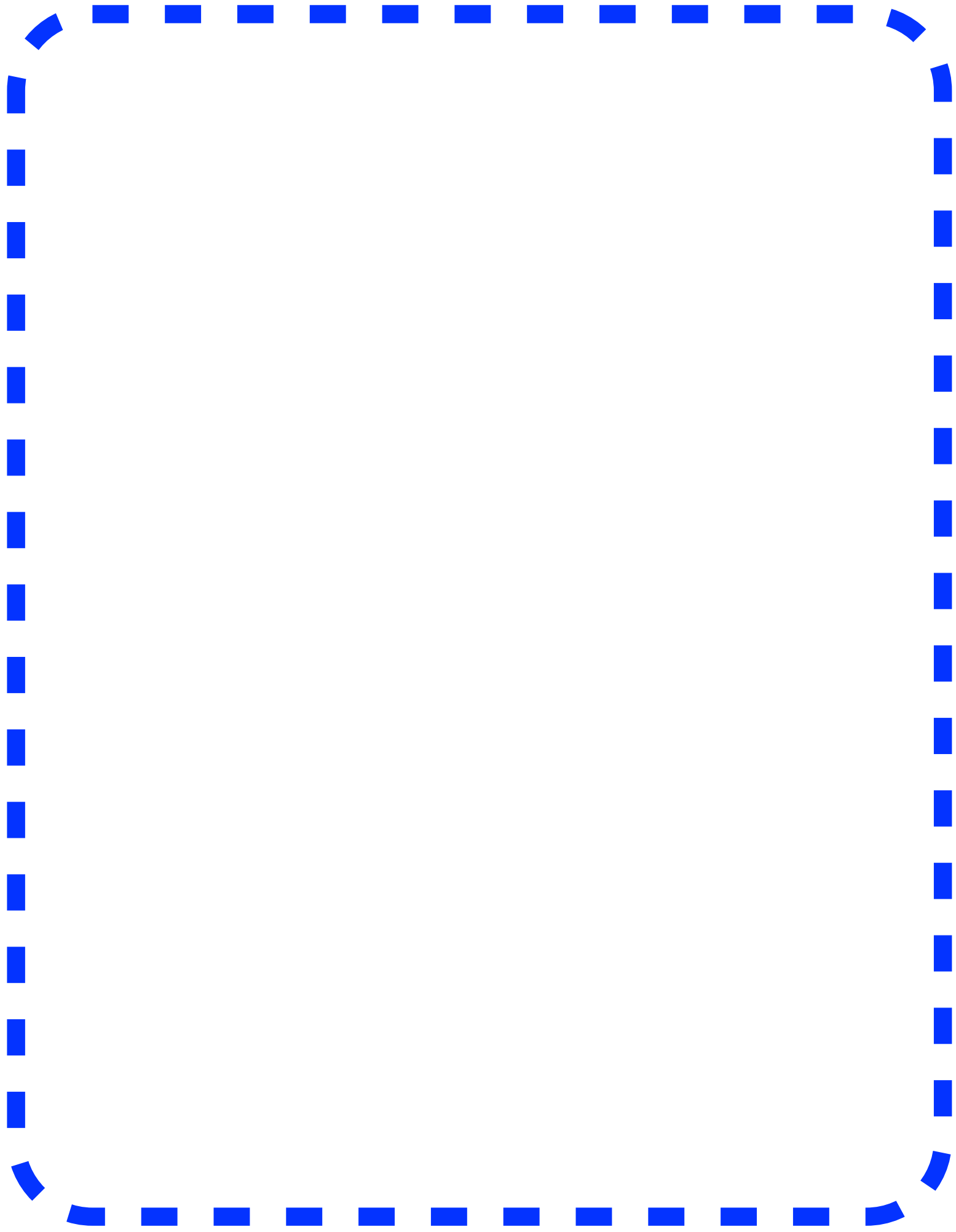

0
−20
−40
−60
−80
Power (dBm)
−30
−20
−10
0
10
20
30
Frequency offset (GHz)
10
9
8.1
7
6.1
5.3
3.9
3.8
2.3

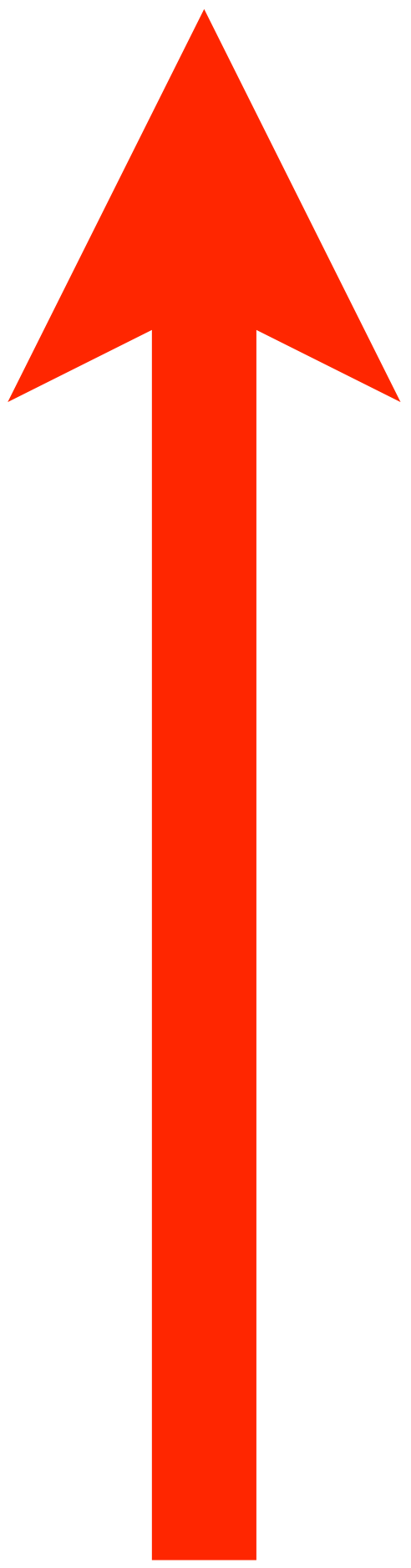

(dBm)

Input power

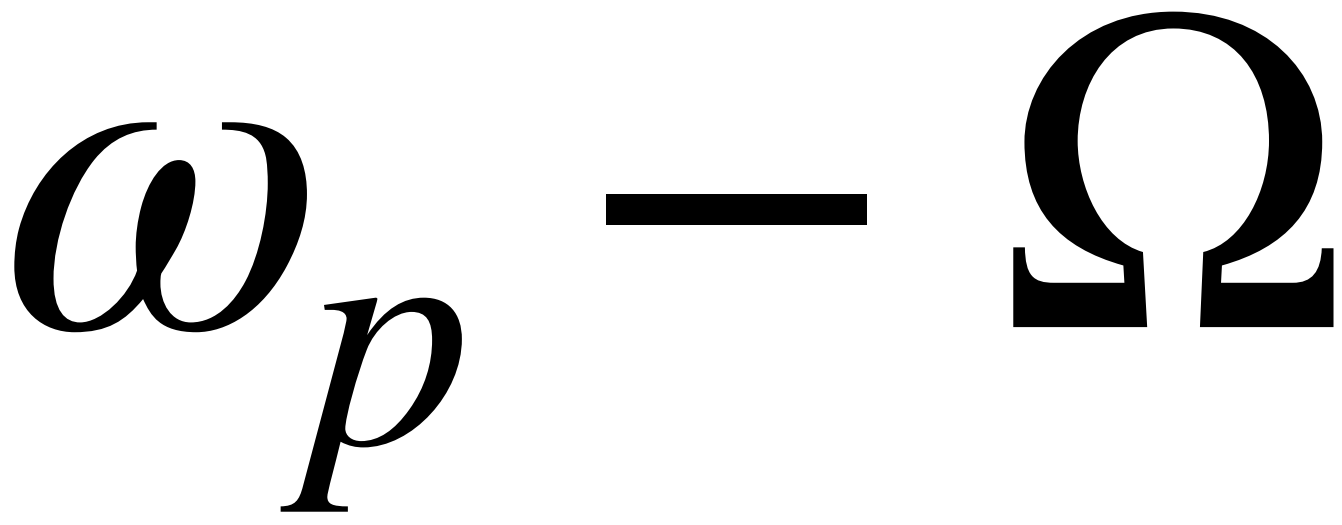


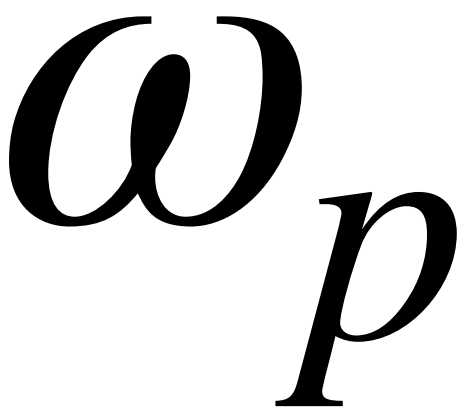


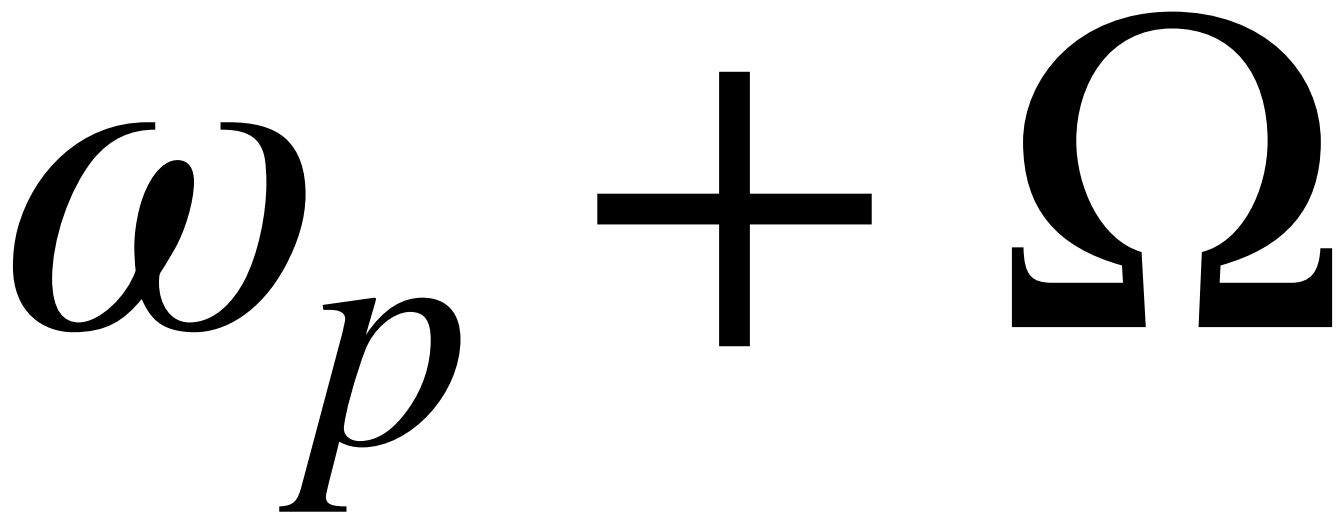


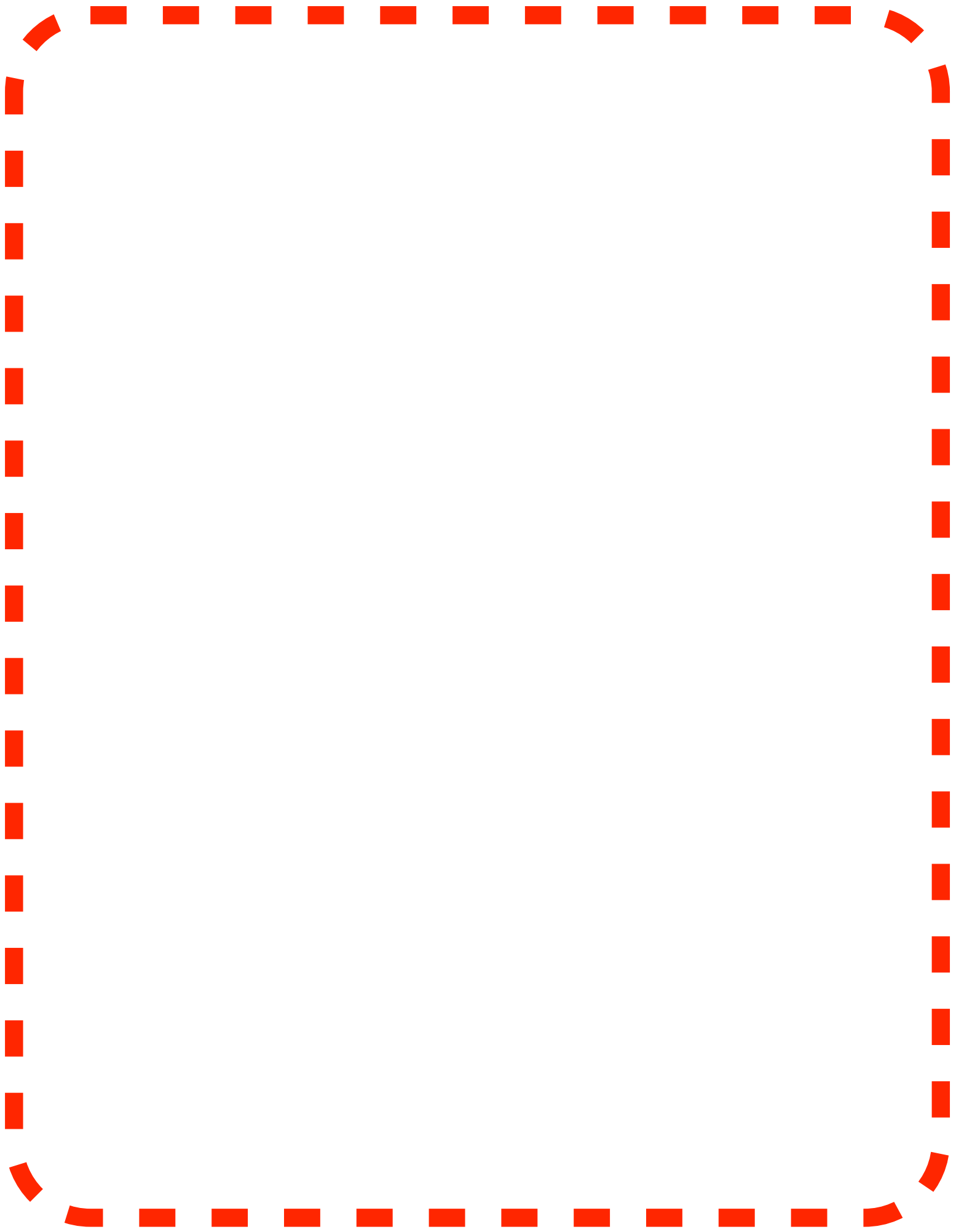


Anti-Stokes



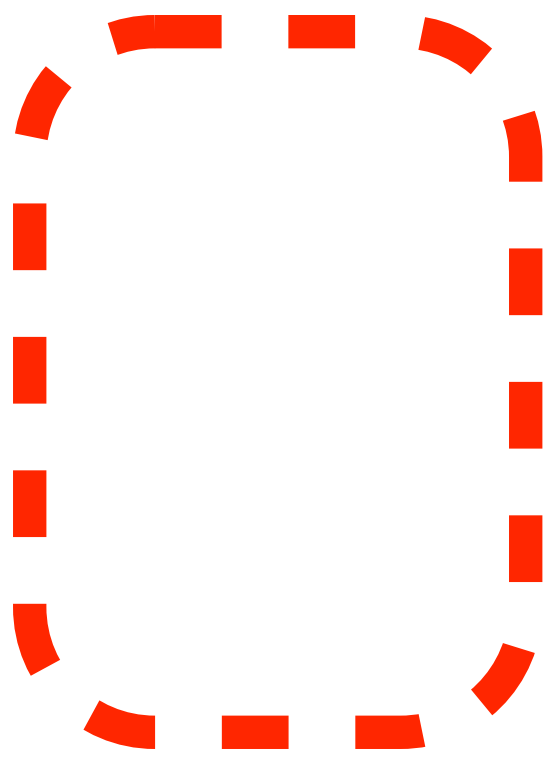


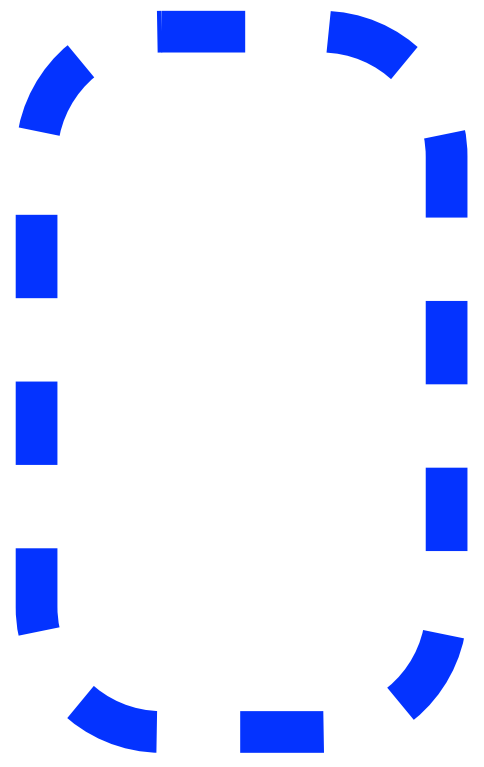




Stokes

$$H_{int} = \hbar g a^{\dagger} a (b^{\dagger} + b)$$



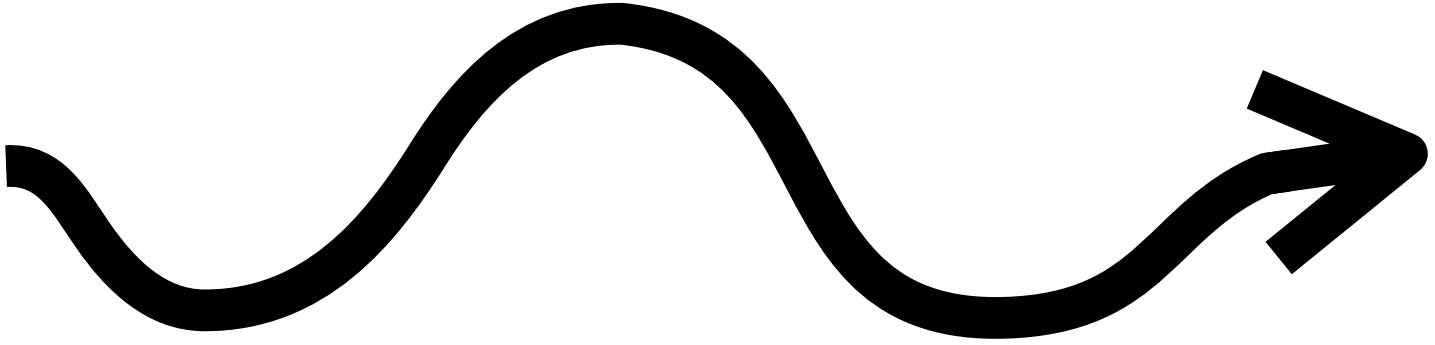


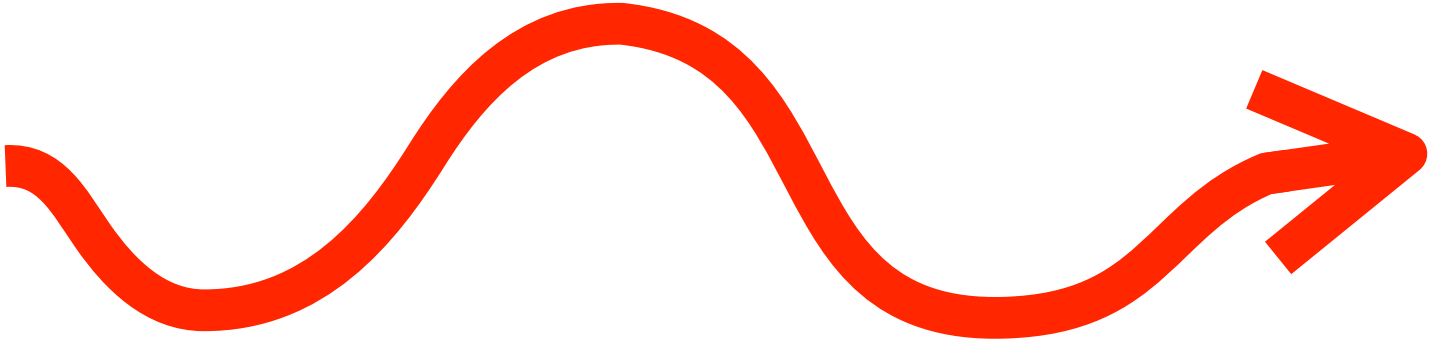
Interaction Hamiltonian

Frequency shift depends

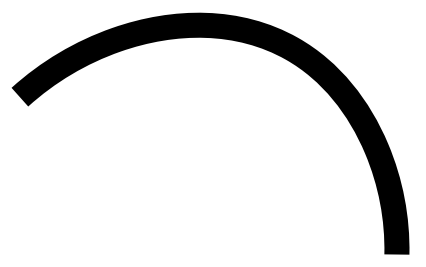
on the scattering direction

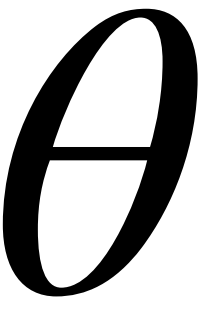
$$|\mathbf{q}| \approx 2|\mathbf{k}|\sin(\theta/2)$$

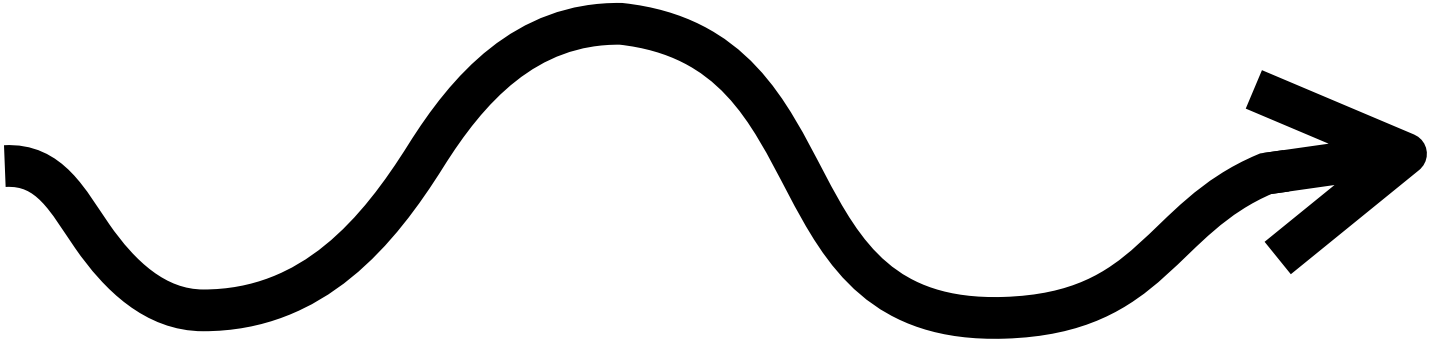


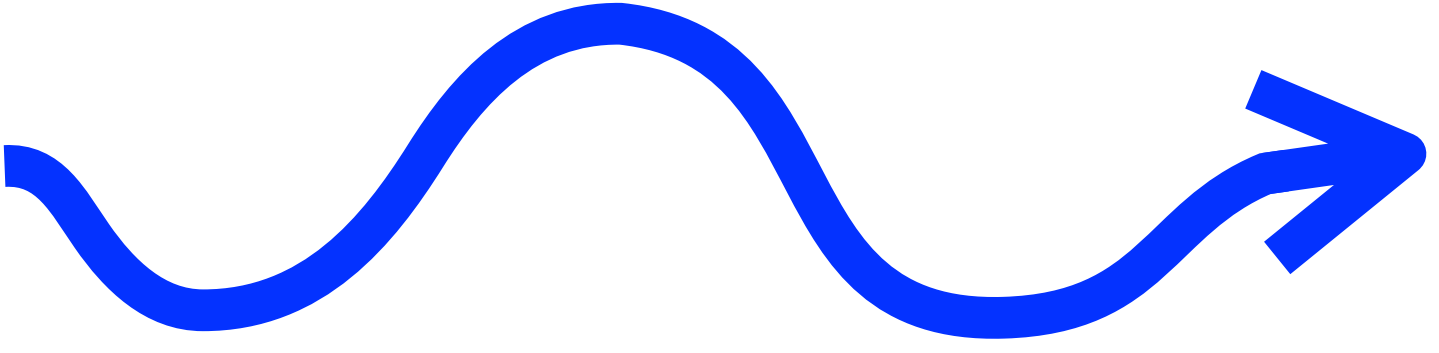


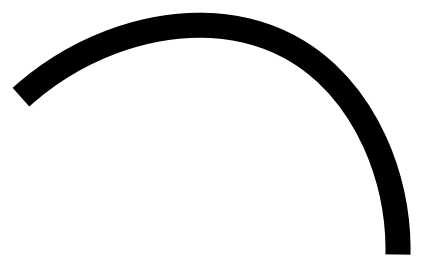
$$\mathbf{k}_p - \mathbf{q} = \mathbf{k}_S$$

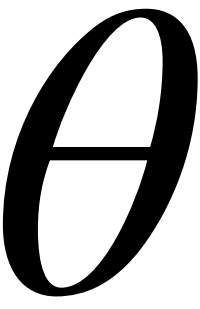


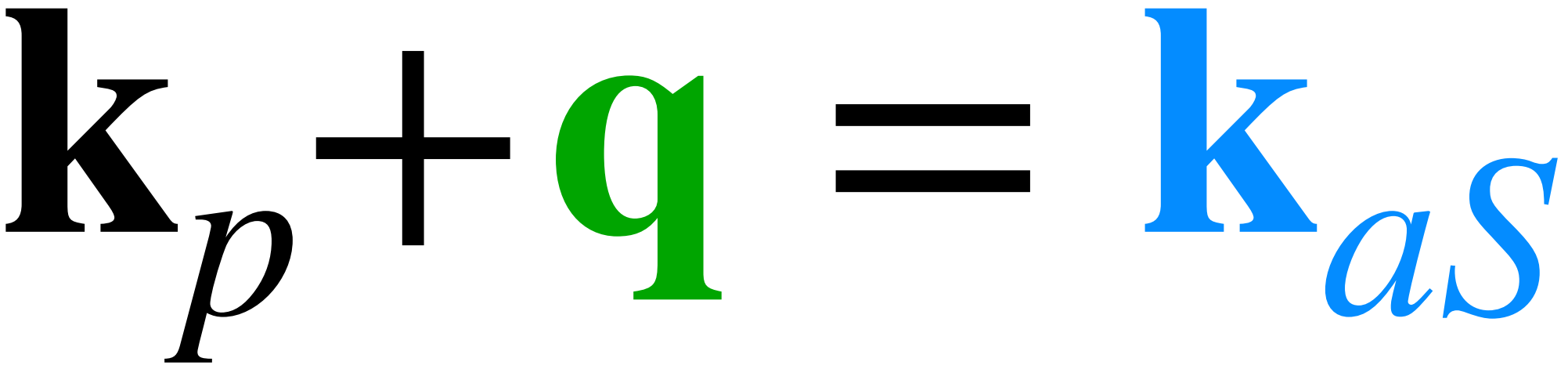


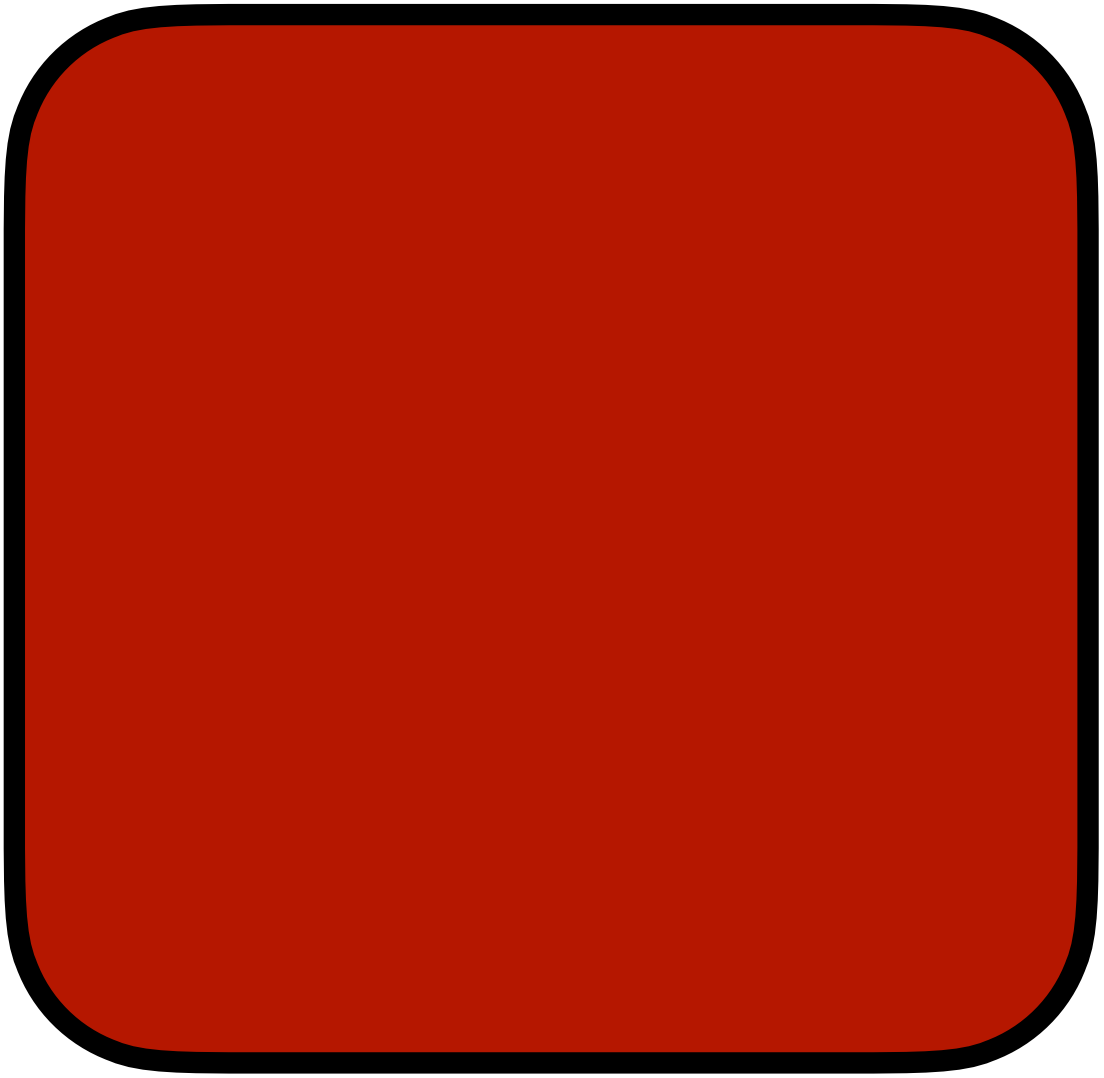


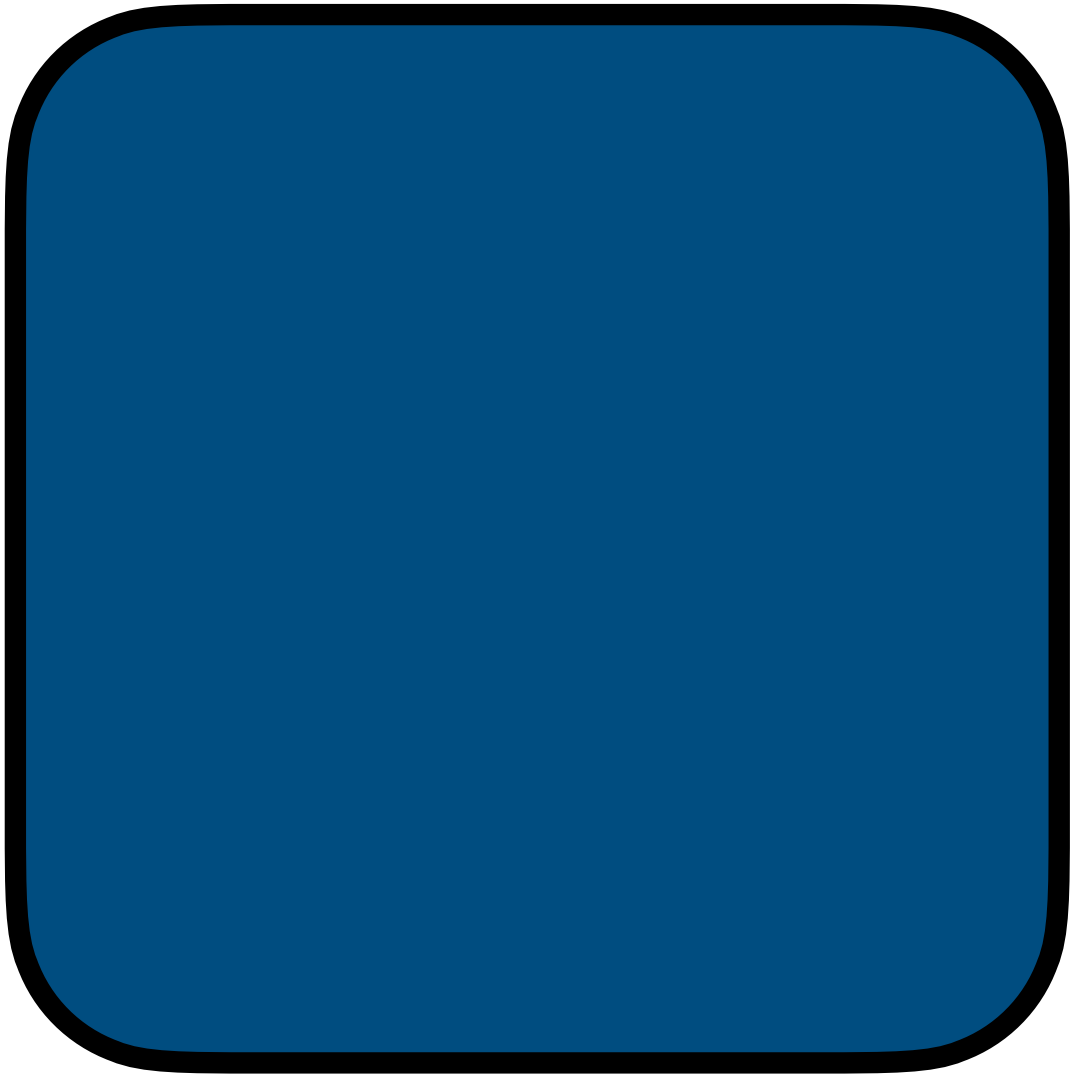






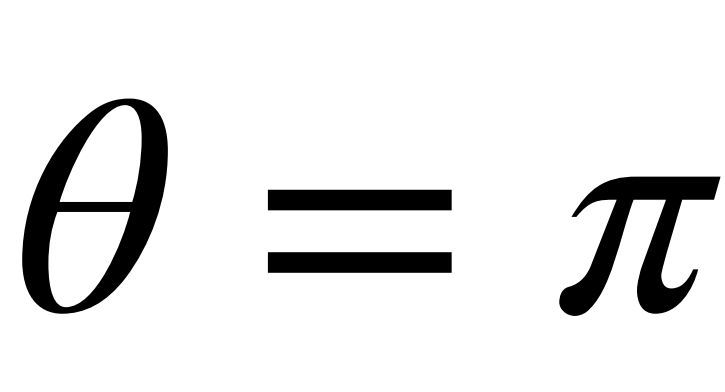

$\mathbf{k}_p + \mathbf{q} = \mathbf{k}_{aS}$



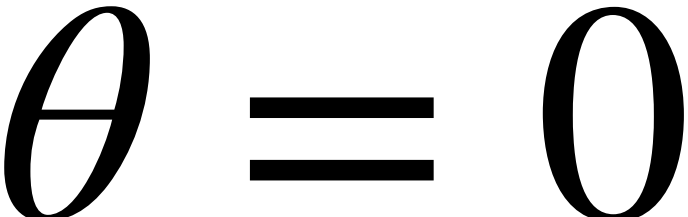


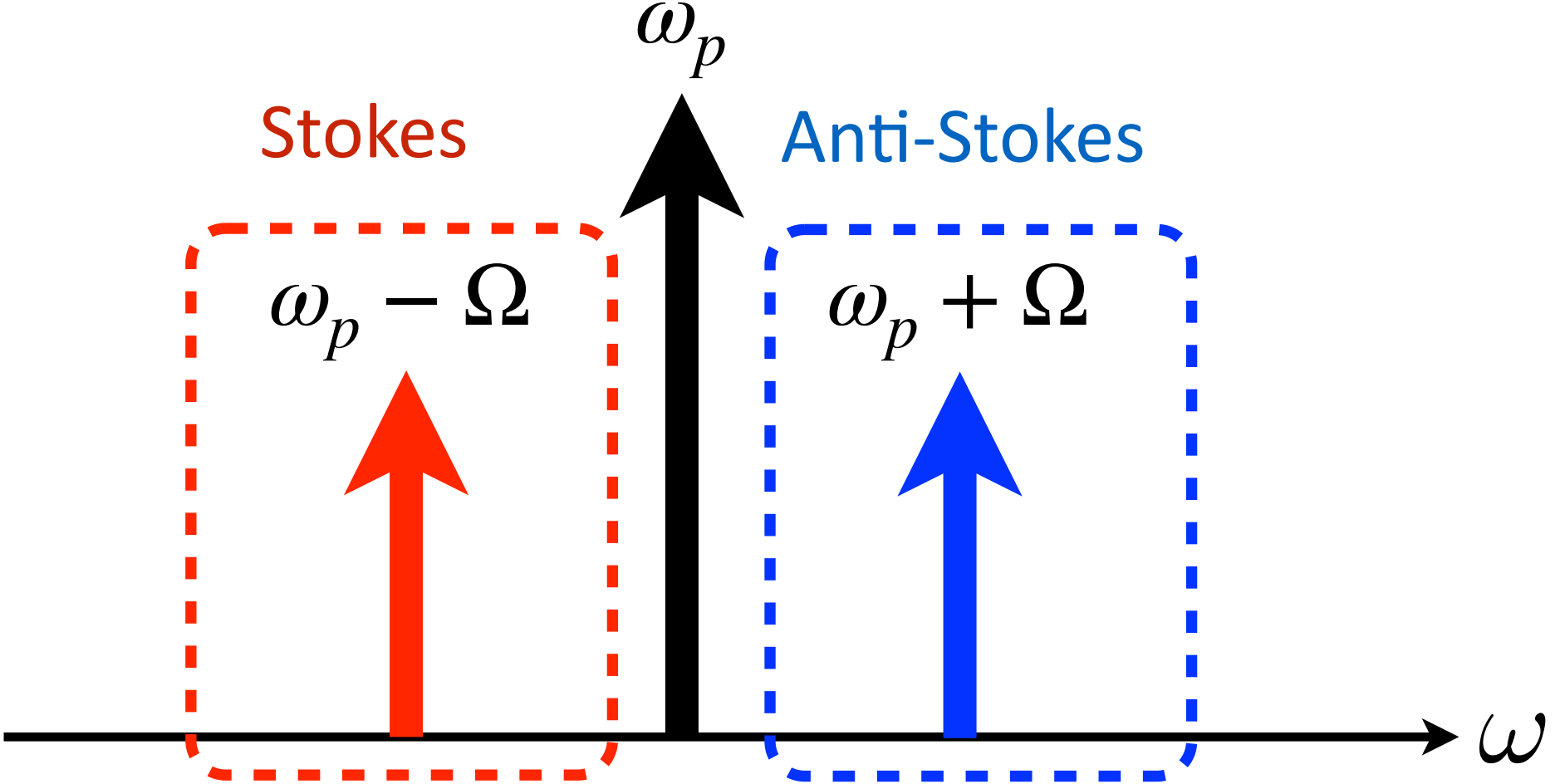
$$0 < |\mathbf{q}| < 2|\mathbf{k}|$$

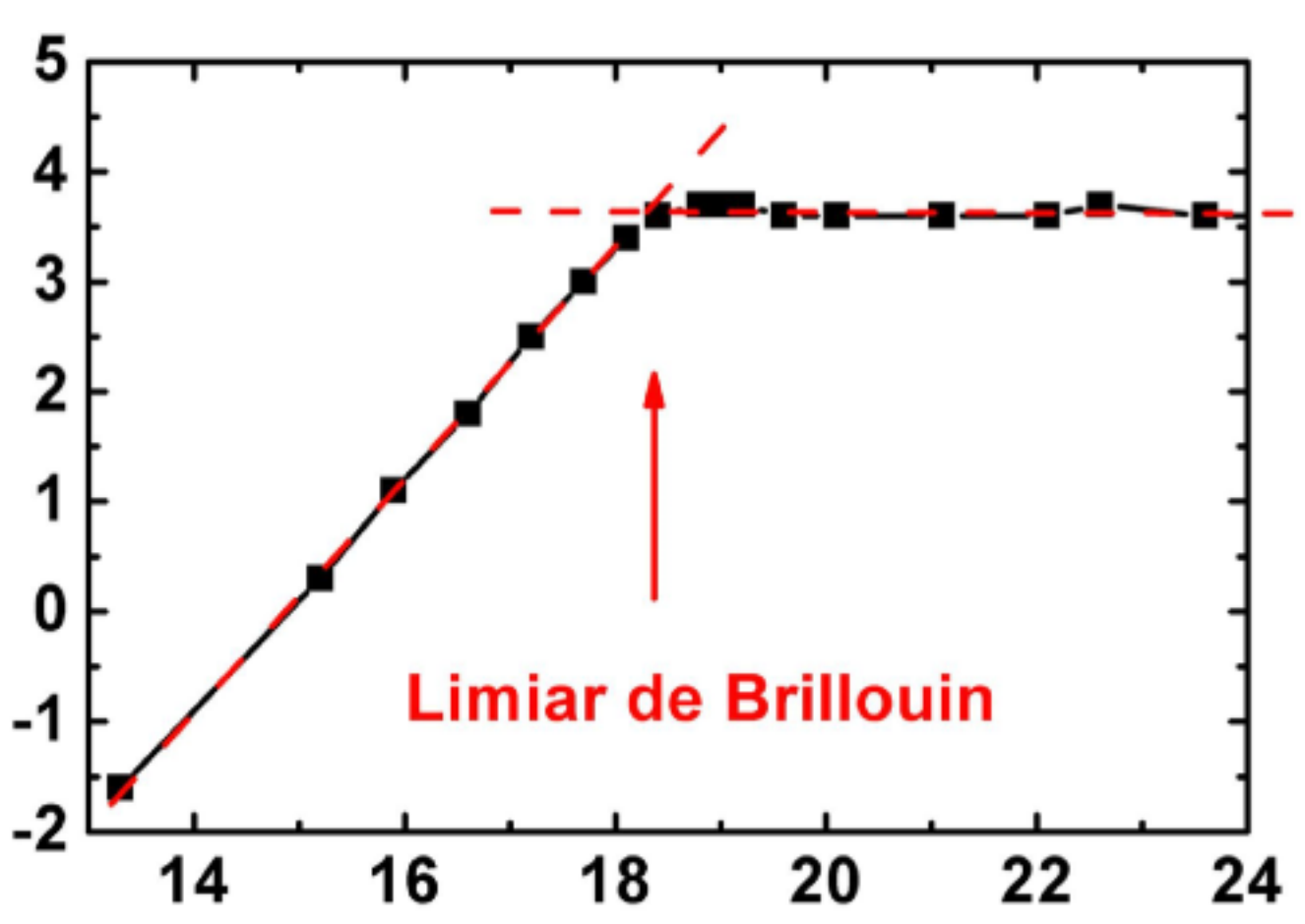
Backward (BW),



Forward (FW),




ω_p
Stokes
Anti-Stokes
$\omega_p - \Omega$
$\omega_p + \Omega$
ω


5
4
3
2
1
0
-1
-2
14
16
18
20
22
24
Limiar de Brillouin

Input power (dBm)

Transmitted power


(dBm)

SBS threshold

10