Dynamic Nuclear Polarization (DNP) aims at transferring the large electron spin polarization to surrounding nuclear spins via microwave irradiation. Dissolution-DNP (d-DNP) experiments are usually performed in frozen samples doped with paramagnetic polarizing agents (PAs) where $^{13}$C polarization enhancements factors as high as 10’000 are possible with respect to thermal polarization in the liquid state [1]. We have recently implemented $^1$H→$^{13}$C cross-polarization (CP) during d-DNP experiment to further boost $^{13}$C enhancements to factors about 50’000 [2].

However, $^1$H→$^{13}$C CP has so far been suboptimal because of the rapid proton relaxation arising from the presence of PAs. We show in this work that $T_{1p}(^1$H) can be significantly extended, and therefore CP greatly improved, by briefly switching off the irradiation prior to CP. During this interruption of microwave irradiation, the electron spins relax from their partially saturated state to their highly polarized state ($P_e = 99.9\%$ at $B_0 = 6.7$ T and $T = 1.2$ K), so that paramagnetic relaxation becomes ineffective. As a result, $T_{1p}(^1$H) is extended by several orders of magnitudes and CP contact times can be lengthened to achieve optimum transfer.

The use of microwave gating in this context has two favourable effects; (i) preventing excessive losses of proton magnetization during spin-locking and (ii) improving the CP transfer efficiency. Altogether, the efficiency of multiple contacts CP is greatly improved by microwave gating; polarizations $P(^{13}$C) as high as 65% was achieved in acetate with an overall polarization build-up time constant as short as 3 min. A record $^{13}$C polarization of 78% was even achieved in $^{13}$C labelled urea.