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The heart of oxygenic photosynthesis illuminated

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THE HEART
OF
OXYGENIC
PHOTOSYNTHESIS
illuminated

Geertje Jacoba Janssen

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The Heart of Oxygenic Photosynthesis illuminated

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THE HEART OF OXYGENIC PHOTOSYNTHESIS illuminated

PROEFSCHRIFT

ter verkrijging van
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LIST OF ABBREVIATIONS

A	Electron acceptor
A ₀	Chl <i>a</i> primary electron acceptor in PSI
A ₁	Quinone secondary electron acceptor in PSI
ALA	δ -aminolevulinic acid
BBY	PSII enriched membrane
BChl	Bacteriochlorophyll
Chl <i>a</i>	Chlorophyll a
Car	Carotenoid
CS	Chemical shift
D	Electron donor
DD	Differential decay
DFT	Density functional theory
DNP	Dynamic nuclear polarization
DR	Differential relaxation
ENDOR	Electron nuclear double resonance
EPR	Electron paramagnetic resonance
ET	Electron transfer
<i>Hb.</i>	Heliobacter
ISC	Intersystem crossing
LCMS	Liquid Chromatography Mass Spectroscopy
MAS	Magic-angle spinning
n.a.	Natural abundance
ns	Nanosecond
NMR	Nuclear magnetic resonance

NPQ	non-photochemical quenching
OEC	Oxygen evolving complex
P _{D1}	Donor Chl <i>a</i> of PSII attached to the D1 branch of the RC
P _M	BChl <i>a</i> of P attached to the M branch of the RC
P _L	BChl <i>a</i> of P attached to the L branch of the RC
Phe <i>a</i>	Pheophytin <i>a</i>
Photo-CIDNP	Photochemically induced nuclear polarization
PSI	Photosystem I
PSII	Photosystem II
QM/MM	Quantum mechanics/molecular mechanics
<i>Rb.</i>	<i>Rhodobacter</i>
RC	Reaction center
rf	Radio-frequency
RPM	Radical pair mechanism
RT	Room temperature (293K)
TNP	Transient nuclear polarization
TOP	Transiently obscured polarization
TSM	Three-spin mixing
WT	Wild type
Φ	Bacteriopheophytin

LIST OF SYMBOLS

A_{zz}	(3,3) element of the hyperfine tensor
A_{zx}, A_{zy}	Pseudosecular elements of the hyperfine interaction
B	Absolute pseudosecular hf interaction

D	Magnitude of the electron-electron dipolar coupling
d	Electron-electron coupling
d_{vdW}	van der Waals distance
I	measured LCMS peak intensity
$I_{\%}$	relative LCMS peak intensity
I_t	calculated true LCMS peak intensity
J	Electron-electron exchange coupling
ρ_i	Electron spin density
S	Singlet radical state
T_0	Triplet state with magnetic quantum number 0
T_{ev}	Evolution time
T_S	Lifetime of the singlet radical state
T_T	Lifetime of the triplet radical state
τ_p	Laser pulse duration
ΔA	Hyperfine anisotropy
Δt	delay time between laser pulse and NMR detection
$\Delta\Omega$	Difference of the electron Zeeman interaction between the two radicals
ω_I	Nuclear Zeeman interaction

